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American Antiquity

A Quarterly Review of American Archaeology

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AMERICAN ANTIQUITY

VOL. VI JULY, 1940 NO. 1

EDITORIALS

WITH the turn of another year the Society for American Archaeology elects new officers. Our President, W. C. McKern, needs no introduction; as our first Editor he established AMERICAN ANTIQUITY on a high plane, and set it up as a going concern. This work, carried on in addition to his manifold duties as Curator of Anthropology of the Milwaukee Public Museum, has earned him a lasting place in the ranks of the Society. Charles Amsden, of the Southwest Museum, Los Angeles, succeeds to the Vice-Presidency. As a diligent worker in the southwestern field he is known to many of us. Thorne Deuel, Director of the Illinois State Museum, takes office as our new Secretary-Treasurer.

To each of these men we offer our hearty congratulations, and assure them of our willing cooperation. Whenever they wish it, space in these pages is open to them. Our President has consented to say a few words in this issue, we will look forward to hearing from our other officers in later numbers.

Carl Guthe has at last been permitted to lay the Secretary's pen down, and to pass on the purse-strings. Perhaps more than any one man he is responsible for the creation of our Society. Through years of service as the Chairman of the Committee on State Archaeological Surveys of the National Research Council he felt the need for an archaeological society. If he is not the father of the Society, he is its god-father. No mere words can express our indebtedness to his unfailing devotion and unflagging interest. Few people know the load that he has carried as Secretary-Treasurer. None will begrudge him his well-earned rest. To him, as well as to the other retiring officers go our sincere thanks and best wishes for the future.

INVENTORY—With the completion of the fifth year of the Society for American Archaeology, and the fifth volume of AMERICAN ANTIQUITY, the general membership may conclude that all major

problems confronting the organization are solved; the time of need for vigorous, concerted effort and careful vigilance past; the goal attained; the battle won. If there are those whose wishful thinking tempts them to harbor such an illusion, it is high time to take stock of the past accomplishments and present status of the Society and its journal in the light of its stated aims and existing needs.

In support of the general program to advance archaeological accomplishment in America, and to serve as an agency for a wider distribution of accurate archaeological information to all interested laymen, the Society from its first inception undertook to sponsor a mutually profitable collaboration between all sincere students of American archaeology whether of professional or amateur status. In fact, this was its major objective. There had developed an unfortunate amount of suspicion and bad feeling between the professional group and various non-professional elements, particularly that group interested in making private collections of archaeological materials. This feeling of mistrust, often intolerance, was founded upon a minimum of fact and a maximum of misunderstanding. It became the initial purpose of the Society to work understandingly toward further decreasing the undesirable fact and eliminating the misunderstanding.

We have been particularly fortunate in the sane, constructive policies selected and developed by our Council, under the very active leadership of our veteran Secretary-Treasurer, Carl Guthe. His has been a laborious, thankless job exceedingly well done. As a result, there is indisputable evidence that progress has been made toward attaining this major objective. Instances can be cited of students who formerly were working at cross-purposes and who now are pulling together toward a mutually recognized objective. Students who have made unfortunate mistakes in the past, due to a failure on the part of more experienced students to offer pertinent information and friendly coöperation, are making fewer mistakes as the result of sincere efforts to place at their disposal the purposes and procedure of improved methods. Professionals who formerly struggled along alone, attempting with the aid of but two eyes to obtain a comprehension of widely scattered phenomena requiring the keen observation of many eyes in many places, are now enjoying a much broader knowledge of their chosen fields as a result of the assistance or inspiration of non-professionals.

However, the struggle to install intelligent coöperation in place of emotional mistrust and destructive competition has just begun. We should take full advantage of these initial successes to strengthen our

position toward continued progress. There are still sincere and intelligent students who believe in warfare rather than peace as a means toward accomplishment.

An important function of the Society has been that of placing at the disposal of students a new medium for the publishing of matter relating to American archaeology. AMERICAN ANTIQUITY has not only served toward satisfying an old demand, but has boldly met the challenge of new demands which it inadvertently created. Under the capable editorship of Douglas Byers and his assistants I foresee that the journal will progressively grow in its scope of service and influence. Such results will depend entirely, however, upon the continued support of the Editor by the membership, and upon a steady increase in the membership. There are thousands of men and women in the Americas who are qualified for membership in the Society. Every member should realize that it is to his own best interests to introduce the Society to these potential members and encourage them to augment our forces.

Actually, we are just entering the most critical period in the history of the Society since that initial year of travail which saw it struggling into existence. Our magazine, regardless of increasing publication costs, must grow in order to meet the growing demands of a constantly expanding field. Moreover, it must soon face the necessity of enlarging the issue to supply an enlarged membership. We must retain the interest and support of present members while soliciting new. We must expand in size, in scope of policy and action, in depth and purity of purpose, and in true worth of accomplishment. In order to present a united front toward accomplishing these ends, we must suppress petty differences arising from purely personal irritation and jealousy. We must develop the habit of logical and judicial appraisal in the light of archaeological objectives, in place of emotional, prejudicial reactions centering about personal feelings, productive of the common "jitters." It is time for wholly adult and sincerely purposeful students to pass on beyond the unorganized, formative period when every man figuratively carries a chip on either shoulder and two "six-guns" at his belt.

W. C. MCKERN, *President*

AN OSSUARY NEAR PISCATAWAY CREEK

ALICE L. L. FERGUSON

WITH

A REPORT ON THE SKELETAL REMAINS

T. D. STEWART

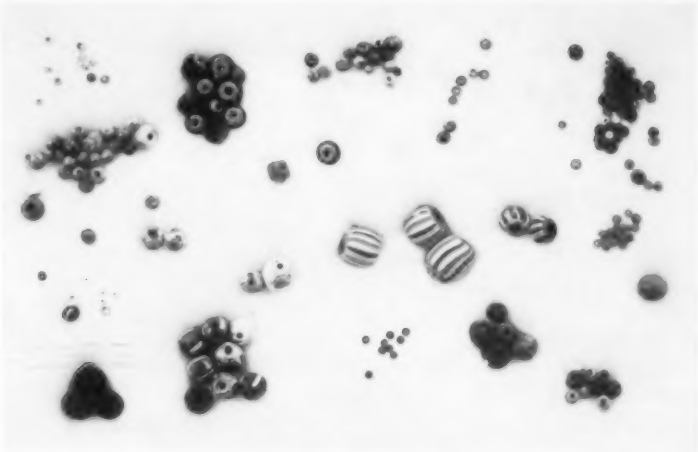
THE ossuary described in this paper is believed to be at or near the site of Piscataway Fort. Piscataway Fort is of historic interest for it was there, in 1634, that Calvert obtained permission from the "Emperor of the Piscataways" to begin the actual settlement of Maryland.

It is thought that until 1623 the principal town of the Piscataways was at Moyaone on the Potomac just below the mouth of Piscataway Creek. In 1623 Governor Wyatt of Virginia burned Moyaone and the principal site of the tribe was probably moved to Piscataway on the south bank of Piscataway Creek two or three miles east of Moyaone.[1] We know that Piscataway Fort was an important place in 1634 and it continued to be the headquarters of the Piscataways, the most important Indians on the Maryland side of the Potomac, until 1680.

Among the things found in this ossuary were some jetons issued in England between 1630 and 1640 during the reign of Charles I. The site of the ossuary checks so well with the land records and the jetons check so well with the known dates of Piscataway Fort that it seems safe to say that this ossuary must have been close to the actual site of the fort.

In 1634 a band of two hundred people led by Lord Baltimore's brother Governor Leonard Calvert, sailed on the *Ark*, a boat of three hundred tons and on a pinnace, the *Dove*, of only fifty tons, and came to America to take possession of Lord Baltimore's new province of Maryland. The little company of adventurers first landed at Point Comfort in Virginia where they stayed several days. At this time they met Captain Claiborne who already knew the country where they intended to go. Claiborne confirmed the reports that they had already received in England that the natives might not be friendly. Two days after they left Point Comfort they came to the Potomac and sailed up the river to an island which they called Saint Clement's which was their first landing place in Maryland. Here they were advised not to make a settlement until they had obtained the permission of the Emperor of the

[1] Ferguson, Alice L. L. *Moyaone and the Piscataway Indians.* (Privately printed, Washington, 1937.)



Trade beads found in the ossuary.

(Slightly less than one-half size)

Piscataways, the most powerful chief on the western shore. Most of the little band stayed on the *Ark* at Saint Clement's while Governor Calvert, accompanied by a small group, with Henry Fleet, a trader and interpreter, went up the Potomac in the *Dove* and one of Fleet's pinnaces to try to find a suitable site for their settlement. They sailed up to Piscataway where they found five hundred bowmen assembled on the shore and the Indians in a disquieting state of watchfulness, with great fires lighted every night all over the country. The Emperor was asked if Calvert and the English could settle on the Indian's land and the Emperor replied "He would not bid him go, neither would he bid him stay but that he might use his own discretion."[2] With this half hearted permission, Fleet piioted the two pinnaces back down the river to Yoacomaco which was chosen as the site of Saint Mary's, the first settlement in Maryland.

At this time the Piscataways and their allies were fighting a losing battle with the Susquehannas and the Iroquois. They could not afford new enemies and there was a possibility that an alliance with the English might turn the tide for them; accordingly a treaty of peace and friendship was made between Calvert and the Piscataways. Because of the need of the Piscataways for keeping the friendship of the English, the colony of Maryland was settled without serious Indian warfare. Unlike its neighbor Virginia, the new and struggling colony suffered no massacres and had very little fear of the Indians. Piscataway Creek became a frontier which the Piscataways held against the onslaughts from the north. The peaceful settlement of the Pautuxent and the southern penninsula was largely owing to the fact that the Piscataways were fighting for their lives and holding the frontier against the Susquehannas and the Iroquois during the first critical years of the new colony. A short history of the Piscataways has already been published and very little could be added here that would not be a repetition.[3]

Although the early records of Maryland are full of references to the Piscataway Indians, Piscataway Fort itself was in existence only during the first forty-six years of Maryland history. The Susquehanna and Iroquois raids became so serious that Piscataway Fort was abandoned in 1680 and the Piscataways retreated to Zachia Swamp. The Piscataways are said to have left Maryland by 1700. For over two hundred years the location of Piscataway Fort was forgotten. Everyone agreed

[2] White, Father Andrew, "A Briefe Relation," page 29 and also "A Relation of Maryland," page 70. *Narratives of Early Maryland* (Scribners, New York, 1925).

[3] Ferguson, *op. cit.*

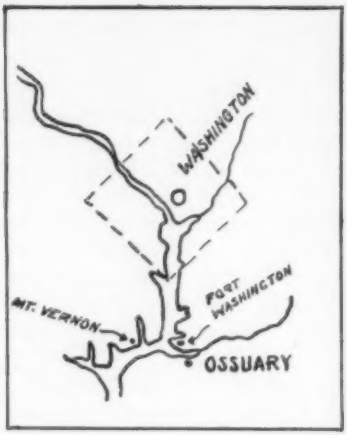


FIG. 1.—Showing the general location of the site.

that it was somewhere around Piscataway Creek but the maps placed it indifferently on the north or south banks.

We had been going past the modern village of Piscataway for years and vaguely wondering about its history and the location of the original Piscataway Fort. In 1935 Mr. William B. Marye published an article on Piscataway with an appendix giving all the available information about the location of the fort that could be culled from the land records.[4] The article by Mr. Marye revived and focused our interest. During the following winters instead of saying to our guests "Let's go for a walk" we said "Let's look for Piscataway." The search was largely confined within the 3,000 acre tract which formed the original grant of Calvert Manor (Figure 2). Large parts of the area under consideration had been uncultivated for years and had grown up to woods and thickets of blackberries and honeysuckle. The surface was nearly everywhere so completely hidden that there was no possibility of picking up the random potsherds and arrow points which are a great help in locating a site. During those winter week-ends, all the possible sites were examined and eventually all but three were eliminated.

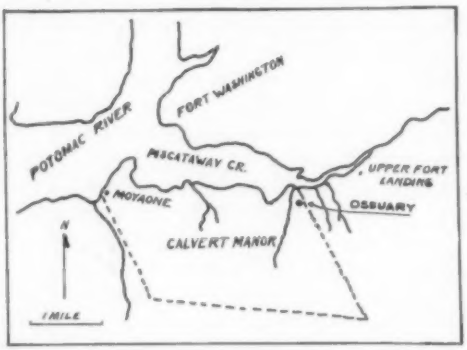


FIG. 2.—Calvert Manor and the site. (*Drawn from U. S. Geological Survey Map.*)

[4] Marye, William B. "Piscattaway," *Maryland Historical Magazine*, Vol. xxx, No. 3, page 183, Baltimore 1935.

One day while riding through a familar wood trail, it suddenly struck us that the trail was cut much too deep. Instead of riding through what we had thought was an abandoned lumber road, we were riding through what had been an important and well used road deeply cut by toiling wagon wheels. A glance at the topographic map showed that the dotted lines of the trail connected with the road to Port Tobacco. The trail had been the last stretch of the road between Port Tobacco and Piscataway which was mentioned so frequently in the early history of Maryland. The road could have led to either of the three sites under consideration. One of the sites was on the John Claggett farm.

Fortunately for the records of Piscataway, there was some conflict in the 18th century as to the eastern boundary of Calvert Manor. The location of Piscataway Fort was of importance in reëstablishing the property line, for according to the principal witnesses, Piscataway Fort was just inside Calvert Manor.

In 1718 and again in 1719 a commission was appointed to resurvey the bounds of Calvert Manor. Marye quotes the deposition Francis Marbury made before the commissions. In either 1695 or 1696 Randall Hanson told Marbury that "Calvert's land (Calvert or Piscataway Manor) joined to his and did take in the Indian fort on the top of a high hill near Piscataway Creek and that he, the said Hanson, was with Lord Baltimore at the choosing of an Indian Emperor at that fort which was in Calvert's land." The fort was abandoned in 1680 but Marbury said that the trenches of the fort were still plainly visible in his time and memory. Marbury's rambling statement is none too clear and it is unnecessary to quote it here since it is available in the appendix to Marye's article. The starting point that the commission used was on the Potomac between Hanson's land and Calvert Manor and that point was easily recovered as it is one of the boundary points of my own farm, Hard Bargain, which is the western portion of the original Calvert Manor. From there the line ran south-southeast 500 perches; thence, south, eighty degrees east and 1,020 perches to some Spanish oaks on the main road from Piscataway to Port Tobacco; thence, north twenty-three degrees west to Piscataway Creek, which line intersected the creek in an ashen pocoson at the mouth of a branch called Piney Branch.

The property owners in the locality had forgotten the names of the little brooks but Piney Branch was verified on a land record map of 1810.[5] In Marbury's deposition, mention was made of the impassable swamp at the mouth of Piney Branch. This swamp or "pocoson" is still

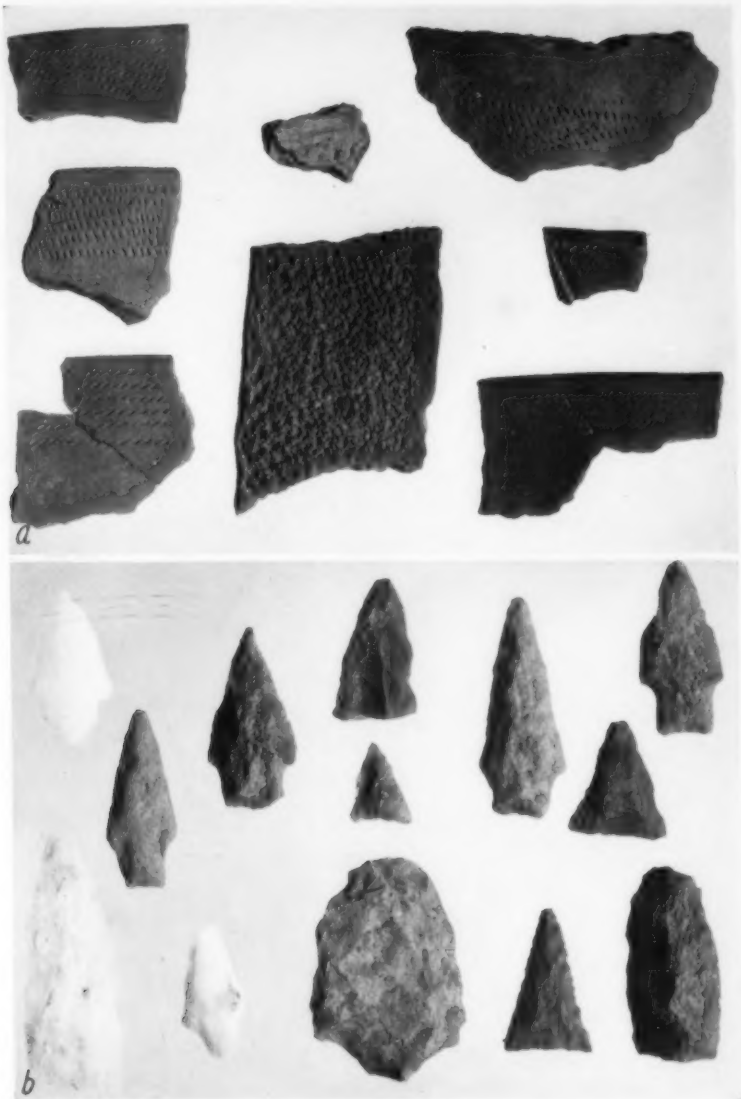
[5] Land Map of John Claggett property, Accokeek, Maryland, at Upper Marlboro.

there and it is really impassable. Quite recently a further verification came when two people were found living in Accokeek who knew the original name of Piney Branch. It will be seen on the map, Figure 2, that the line of Calvert Manor just encloses the site that contains the ossuary. It can readily be understood that if this is the site of Piscataway Fort the nearness to the boundary would have been the reason why the commissioners were so interested in the location of Piscataway Fort when they were trying to run the disputed line of Calvert Manor.

Another piece of evidence which figured in the land records was the name "Upper Fort Landing." This is shown on the land record maps and also on the map Figure 2. It marked the point where the boundary line between two nearby estates, Saint James and Saint Anthony's, touched the creek shore. Owing to the silting up of Piscataway Creek in historic times, the shore line, especially in the upper reaches, has crept out and the landing is now in a marsh. If the fort was inside Calvert Manor and also down stream from the Upper Fort Landing, it would of necessity have to be very near the site of this ossuary.

Our finding of the ossuary was considerably postponed owing to the statement in Marbury's deposition that the fort was on a high hill near Piscataway Creek. No hills are near the creek. They are all so far back that it is difficult to imagine any protection for the canoes and there was also a scarcity of drinking water which was an essential in a village of any size. The site that we found was on rising ground but certainly not on a hill. From Marbury's deposition it appears he never actually visited the site but saw the remains of the fort from a boat in Piscataway Creek. This was many years before he made his statement and to his recollection the rising ground south of the creek might have appeared as a hill.

After excavating the site of Moyaone for three and a half years we came to what seemed to be the end of the essential work there and there was still a little time before cold weather. The Claggett farm was for sale and as Mr. Claggett had very kindly given us permission to dig, it seemed wise to take the opportunity to see what was under the blackberry bushes before the city pushed out and the farm became another subdivision. At the end of the first half-day's work we had found three pits and the ossuary. We explored the site for several weeks, but owing to the lack of shelter there, we worked only in good weather and continued the work at Moyaone on rainy days. After a program had been followed for a short time, another discovery was made at Moyaone and all ideas of developing the Piscataway site had to be abandoned.



Sherds and projectile points

a. European clay pipe from Pit No. 6, Indian pipes from Pit No. 9. *b*. Tubular copper beads, fastened together lengthwise.

In the few weeks that we worked at Piscataway a few additional pits and trenches were uncovered. The material was what would have been expected if the site had been Piscataway Fort, but there was very little of it. We know from history that the fort existed at least 46 years. We did not find enough pits or surface material to justify a statement that we were actually inside the fort, but the evidence suggested that if the site were not the fort itself it must have been very near it.

The soil was characteristic of much of this part of Maryland. On the slopes it was almost pure gravel and on the bottom lands it was gravel bound by a stiff gray clay. It was an exceedingly difficult soil to dig. Much of the work had to be done with mattocks, and breaking spades was a frequent occurence. A pit was found with three burials. It was impossible to drive a trowel into the ground. The clay which bound the pebbles around the skeletons was baked in the summer heat. The stones and clay were much harder than the frail bones which broke hopelessly when the effort was made to extricate them. In a few pits where there was a great deal of ash, the soil was more amenable but all through the site the digging was slow and discouraging. At the site of Moyaone our regular method was to strip back the top soil but here the work was so laborious that stripping and hunting for post moulds was out of the question.

Unlike the site of Moyaone there were traces of white contact everywhere, both in the surface material and in the pits. White clay pipe fragments of European manufacture were especially abundant.

There seemed to have been an intricate system of trenches on the site. There was no object in having drainage ditches in those fields and it is impossible to give any explanation of these trenches without more complete exploration and mapping than could be done in the time available. The four trenches found were about two feet across, and averaged about two and a half feet deep which was too small to have afforded any protection. One of the trenches was partially filled with village waste. There were bones of deer and other animals, considerable charcoal and ash, fragments of both trade and Indian pipes and a great many unusually large potsherds.

Only three fire pits were discovered. These were a foot to a foot and a half in diameter and about eight inches deep. All of them had ash, charcoal and a few potsherds.

There was one burial pit with three burials but the bones were recovered in such a fragmentary condition that no measurements were possible.

Three large pits were found. Two were about 14 feet by 15 feet on the surface, 3.7 feet deep and they ran together at one end. The material from both of these pits was predominately Indian. One of them had a fragment of a steatite pipe and a considerable number of pipe fragments made from a fine red pipe clay (Plate III, *a*). Most of the native pipes in the locality were very short but the stems of these were as long as those of the trade pipes which they apparently imitated. The other pit was 15 feet by 11 feet and contained a great deal of waste material. There were a few Indian potsherds and pipe fragments in the pit, but almost everything else in it had belonged to white men. There were the bottoms of glass bottles, glazed pottery, a large pewter spoon, an iron spoon 19 inches long the bowl of which had been reworked, an iron hoe, some broken knives, 301 fragments of European clay pipes, all of the same pattern, (Plate III, *a*) a few bones of pigs and cows and large quantities of deer bones. This pit was so evidently a white man's pit that it could have been the cellar of a trading post or might possibly have had some connection with the colonial garrison which was kept at Piscataway in 1644 and 1645.

The ossuary, or great common burial pit, was 16 feet wide by 20 feet long and 3½ feet deep at the deepest point. Unlike the ossuaries at Moyaone it had a vacant space in the center where the earth was completely undisturbed. When this undisturbed earth was first found, we thought that there were two ossuaries which had run together at the end where we began to work, but the bone stratum was found again at the other side with no indication of an interruption or that the bones had been placed there at different times. It was an exceedingly difficult ossuary to dig, owing to the stiff clay and large heavy pebbles. In dry weather the ground was as hard as cement and in wet weather it was like soup. In the ossuaries at Moyaone the sand and dirt which had worked into the skulls and filled them completely, helped to keep them in shape. Owing to the inflexible character of these stones and lumps of clay, nothing had slipped through the small skull openings and the skulls were all hollow. Any effort to loosen the rocks that wedged the bones collapsed the skulls. Usually three or four skulls broke at once and there was nothing to do but pick up the fragments and hope that the right pieces had been placed in the right baskets. Only a small percentage of the skulls were restored and almost all of these came from one end where there was a trifle more sand in the soil and not so many rocks.

The ossuary contained 254 skulls and one deposit of cremated bones. The cremation, as far as it could be identified consisted of the thor-

oughly burned bone fragments of a young male adult. Most of the fragments were so small that it was impossible to identify them, but almost all the ~~supraorbital~~ frontal bones were found. The actual cremation had not taken place in the ossuary, for the mass of charcoal, fine ash and burnt bones had sifted in among other bones which showed no sign of having been even scorched.

As in the ossuaries found on the neighboring site of Moyaone, the number of skulls was too great for the number of other bones. Apparently the skull was the most important part of the burial, and received the most careful attention. A skull properly prepared for burial always had a toe bone in it, frequently a rib or two and sometimes all the stray bones that could be jammed into it. Occasionally so many bones were forced into a skull that it was broken from the inside. Beads were found in some of the skulls but in this ossuary the complete necklaces were found outside the skulls and not in them as at Moyaone.

No arrow points or pipes were found in the ossuary and very few potsherds. There was a perfect celt ten inches long and two fossil shark teeth. As in the ossuaries near Port Tobacco,[6] probably contemporaneous with Piscataway, there were abundant trade objects and in general there was a marked similarity between the things found at the two sites. Apparently the objects found at Piscataway were richer and more varied, as would be expected if Piscataway was the seat of the emperor, and Port Tobacco that of a tributary king.

The most abundant trade objects were little glass beads of a turquoise blue color. Over three pints of these were recovered. A great many of them were extremely small, of the size that is used for bead embroidery. These small beads were also found in red, white, blue and black but the blue greatly predominated. There were a few light blue iridescent Venetian beads and a half dozen large beads with red and blue stripes on a white ground (Plate I).

The real wealth from the ossuary was the trade copper. Seven hawk bells of the ordinary size were found as was a much larger one which had something wrapped around it, probably leather. There was a strange copper coil and also two wrapped pieces of copper very suggestive of finger rings (Plate V, *a*). Near the edge of the pit there was what had probably been a crude leather pouch filled with the bones of a very young infant, tubular copper beads and parts of a string shell beads. Scattered all through the ossuary there was a great abundance of copper tubular

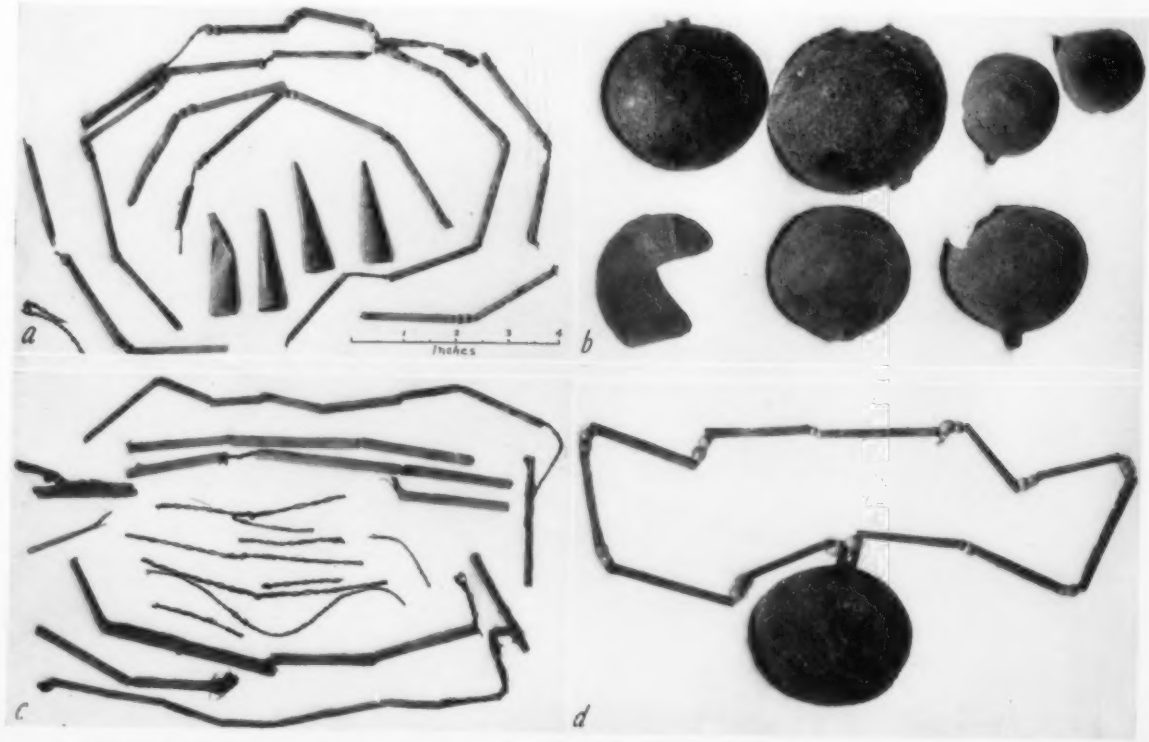
[6] Graham, William J. *The Indians of Port Tobacco River, Maryland, and Their Burial Places.* (Privately printed, Washington, 1935.)

beads of differing sizes and weights. In one place a great number of beads were found stuck together sideways (Plate III, *b*). No information seems to be available about copper beads of this type but they look as though the traders might have got them from the manufacturers in blocks instead of loose. They would have been like the modern postage stamps, much easier to count in sheets. All of the necklaces and many of the beads had fragments of the original string which appeared to have been made from a vegetable fibre. The string in the shell beads from the leather pouch was exceedingly fine but all the other pieces of string looked very much like our own, but very loosely twisted (Plate IV, *c*). A clay impression taken from the decoration on one of the pieces of pottery showed that it had been marked by string similar to this.

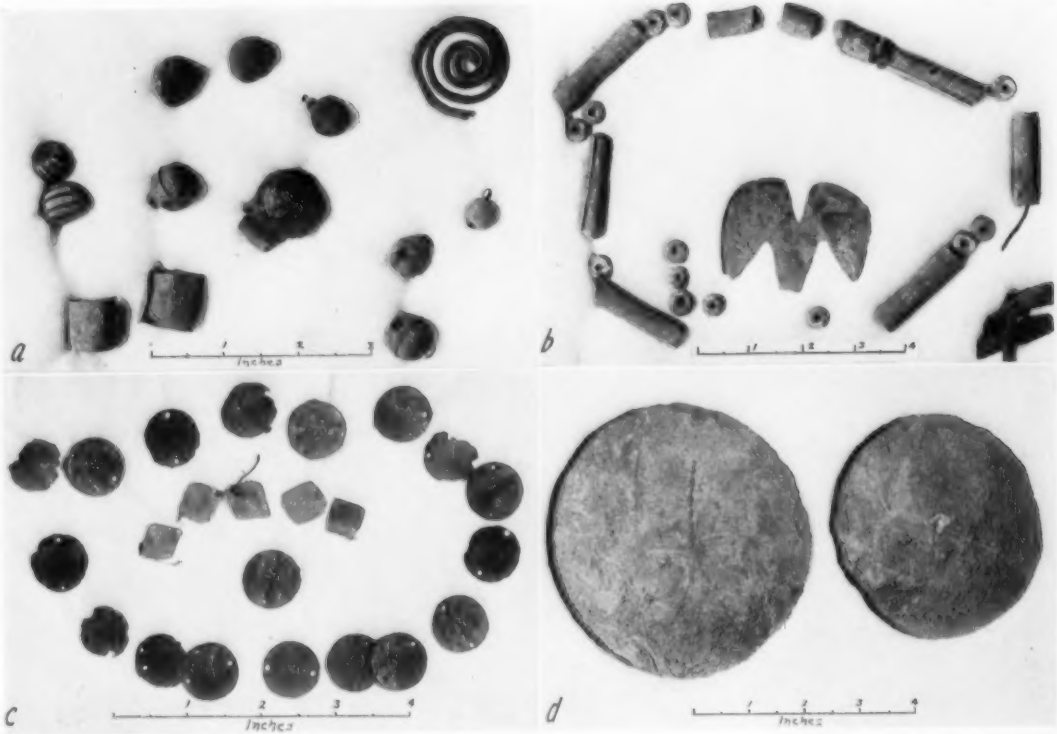
The portions of the necklaces with the string still in place showed that it was customary to string the necklaces by alternating the copper beads with either blue beads or flat disk-shaped shell beads (Plates IV, *a* and V, *b*). Several copper beads are shown in the photographs with the alternating beads wedged into them. One necklace was reassembled in the way many of the fragments were found (Plate IV, *d*).

The most showy copper ornaments were the large round discs perforated so that they could be worn as pendants (Plate IV, *b*). All but four of them were found singly. Four of the discs were found in pairs. These were apparently hung together one over the other and they must have made a very ostentatious clatter as their wearer moved. The disc pendant shown on Plate IV, *d*, has the arcuate scar of another disc of about the same size found above it. One of the discs was so intimately associated with a scalp that a large fragment of the scalp was preserved by the oxidation of the copper. This scalp had apparently been used as an ornament for it was not associated with a skull (Plate VI, *b*). The most interesting of the discs were the two largest. Each has a small perforation in the center but none at the margin. They were found one on each side of a skull and may have been parts of a headdress (Plate V, *d*). They not only had turned the skull bright green but where they came in contact with the skull they had preserved the hair and parts of the scalp. On the convex side of the discs, fragments of a piece of rough cloth wrapped around the skull were preserved and outside the cloth there were fragments of a fibre mat (Plate VI, *a*). It is very likely that the entire body was wrapped first in cloth and then in a mat and that the copper preserved the small fragments around the skull.

Several of the necklaces were very elaborate. One of them had conical copper pendants the size and shape of tubular pipes (Plate IV, *a*).



a, b, c. Elements of necklaces found in the ossuary. The plates in *b* are perforated for suspension. *d.* A necklace reassembled from these elements.



a. Hawk bells, a spiral coil, two rolled strips, all of copper, two red and white glass beads. *b*. Necklace of copper tubes and shell beads, and a pendant suggestive of an eagle. *c*. Necklace elements: copper squares with original string, copper jetons or medalettes. *d*. Large copper discs with central perforation.

Another pendant exactly like these was found at Moyaone in the topsoil directly above ossuary No. 4. Possibly the owner had lost one at Moyaone and afterward been buried at Piscataway with the others. Another necklace had a strangely shaped figure suggestive of an eagle with a piece of the copper folded over on the back to permit a cord to pass through (Plate V, *b*). Plate V, *c* shows five delicate little copper lozenges with no ornamentation and each one perforated on two corners. When they were found they were all strung together with the cord passing to the back but the cord was so frail that at the time of the photograph only two squares were still in place on their string.

The most elaborate of all the necklaces consists of eighteen little copper jetons or medalettes (Plate V, *c*). Each jeton is stamped with a rose crossed by a thistle and surmounted by a crown. The reverse side is blank. There is no record that other jetons of this type have been found in this country. The Department of Coins and Medals of the British Museum reported that they were issued between 1630 and 1640 in the reign of Charles I and that they were used as admission pieces to the ceremony of the King's Touch.

REPORT ON SKELETAL REMAINS FROM THE PISCATAWAY CREEK OSSUARY

Since 1933 the writer has participated in the excavation of eight ossuaries at three Indian sites along the Potomac River.[7] During this time also he has examined skeletal remains from nearly as many more. Owing to the fact that in secondary burials it is impossible to recover whole skeletons, one of the problems connected with the study of these ossuaries is the determination of the number of individuals and their age distribution. Sex identification is inaccurate without the whole skeleton. Additional interest attaches to the physical relationship of the ossuary populations to one another and to more distant Indian groups.

The determination of these facts in the case of the Potomac River ossuaries is complicated by the poor state of bone preservation. At some sites it has been impossible to recover more than one or two restorable skulls. Also, in these cases, the ends of the long bones are badly decomposed.

[7] Graham, Wm. J. *The Indians of Port Tobacco River, Maryland, and Their Burial Places.* (Privately printed Washington, 1935.) Stewart, T. D. and Wedel, W. R. "The finding of two ossuaries on the site of the Indian village of Nacotchtanke (Anacostia)." *Journal of the Washington Academy of Sciences,* XXVII, No. 5, 1937, pp. 213–219. Stewart, T. D. "Excavating the Indian village of Patawomeke (Potomac)." From *Explorations and Field-Work of the Smithsonian Institution,* 1938, publ. 1939, pp. 87–90.

or medalettes. *d*, Large copper discs with central perforation.

When I first encountered this combination of circumstances, the situation demanded an immediate decision as regards the skeletal parts to be saved. Knowing that relationships here would depend largely on the study of non-metrical characters and furthermore that storage facilities would not permit the preservation of many different bones, I made the following selection: 1) All whole or restorable skulls and long bones; 2) Any bones with anomalies or pathological changes; and 3) Otherwise only temporal bones, lower jaws, distal ends of humeri and proximal ends of femora. A count of these parts, according to side, should give the size of the ossuary population. The stages of tooth eruption in the lower jaws should give the age distribution. These bones also furnish four important non-metrical characters: 1) Ear exostosis; 2) Perforation of the tympanic plate; 3) Septal aperture of the humerus; and 4) Third trochanter of the femur.

At the time the Piscataway Creek ossuary was excavated, Mrs. Ferguson was familiar with my reasons for selecting for preservation the bones listed above. This being the case, and since the plan was for me to study them, only these parts were saved. Naturally the accuracy of the information obtained from this selection of bones must be evaluated according to the conditions under which they were recovered. A physical anthropologist would recognize more of these bones in fragmentary states than would someone lacking a training in osteology; the physical anthropologist would also detect more pathological changes and anomalies. It should be stated, therefore, that the full contents of the Piscataway ossuary was not examined by, nor a selection made from it by, a physical anthropologist.

The following observations on the skeletal material from this site should be considered as preliminary to a future broader study covering all of the remains of the Potomac River Indians.

Number of individuals. The counts of individual bones recovered are tabulated herewith according to side. Comparison is made with the records of the first ossuary on the Ferguson farm near Accokeek,[8] in which case the writer had the opportunity to make his own selection from the excavated material:

	Accokeek #1	*Piscataway*	*Difference*
Temporal bones	R 261	200	− 61
	L 253	207	− 46

[8] This site is referred to as Moyaone in the preceding section. (*A.L.L.F.*)

	Accokeek #1	*Piscataway*	*Difference*
Lower jaws[9]	235	122	−113
Humeri (distal)	R 154	142	− 12
	L 161	142	− 19
Femora (proximal)	R 178	167	− 11
	L 180	175	− 5

This table bears out two points which are true to my experience at other sites; namely, 1) that more skulls are recovered than long bones and 2) that temporal bones usually furnish the best check on the number of individuals. I have noted elsewhere[10] the possible reasons for the recovery of more skulls than long bones.

Sex. From general observations on skulls and long bones, it appears that there is no unusual disproportion in the numbers of the two sexes represented.

Age. From the stages of tooth eruption in the lower jaws, the following age classes and their frequencies were established:

2– 6 years	(Temporary M2 erupted, permanent M1 unerupted)	11
6–12 years	(Permanent M1 erupted, M2 unerupted, temporary M2 often present)	18
adolescent	(M3 incompletely erupted)	8
adult	(All permanent teeth erupted)	85

Attention is called to the absence of individuals under two years of age. In the first ossuary at Accokeek there were eight individuals between one and two years of age. It was noted also that relatively few of the skulls recovered at Piscataway were accompanied by lower jaws. I am unable to say whether this is due to the method of collection, or method of burial.

Cranial index. The recovered skulls included 32 males and 24 females that were free from post-mortem compression and complete enough to permit measurement of length and breadth. The range of the cranial indices derived from these two measurements extends from 65.8 (female) to 90.9 (female). This range exceeds that of the series from the first Accokeek ossuary. However, if we take the next two individuals in

[9] Only symphyses counted.

[10] Stewart and Wedel, *op. cit.*, p. 217.

the Piscataway series, the range becomes 66.4 (male)–84.6 (female), which is almost identical with that of the first Accokeek ossuary. There is the following distribution for each sex:

		Male	*Female*
Hyperdolichocrany	65.0–69.9	6	2
Dolichocrany	70.0–74.9	10	7
Mesocrany	75.0–79.9	9	7
Brachycrany	80.0–84.9	7	7
Hyperbrachycrany	85.0–89.9	—	—
Ultrabrachycrany	90.0–94.9	—	1

This distribution of the cranial index shows a somewhat larger number of brachycranic individuals than was true of the first Accokeek ossuary, but otherwise is very similar to the latter.

Anomalies. The following table shows the frequencies for the present series of the four anomalies mentioned above which I have been studying in various skeletal series from eastern North America:[11]

Anomaly	*Number*	% *Absent*	% *Present* *Small*	*Medium*	*Large*	% *Present* *Weighted*[12]
Ear exostosis	341	92.4	6.7	0.9	—	2.8
Perforation of the tympanic plate	327	69.1	14.4	12.8	3.7	17.0
Septal aperture of the humerus	260	59.6	13.8	15.4	11.2	26.1
3rd trochanter of the femur	285	46.0	33.3	16.5	4.2	26.3

When the figures in the last column are compared with similar data from other localities (next table), it will be noted that there is general agreement for all the Maryland and eastern Virginia data. The most variable feature seems to be the third trochanter of the femur, and here it is possible that the fluctuations are partly due to observational error.

Stature. A good series of whole femora was recovered in the Piscataway ossuary. This series may be divided into two groups representing

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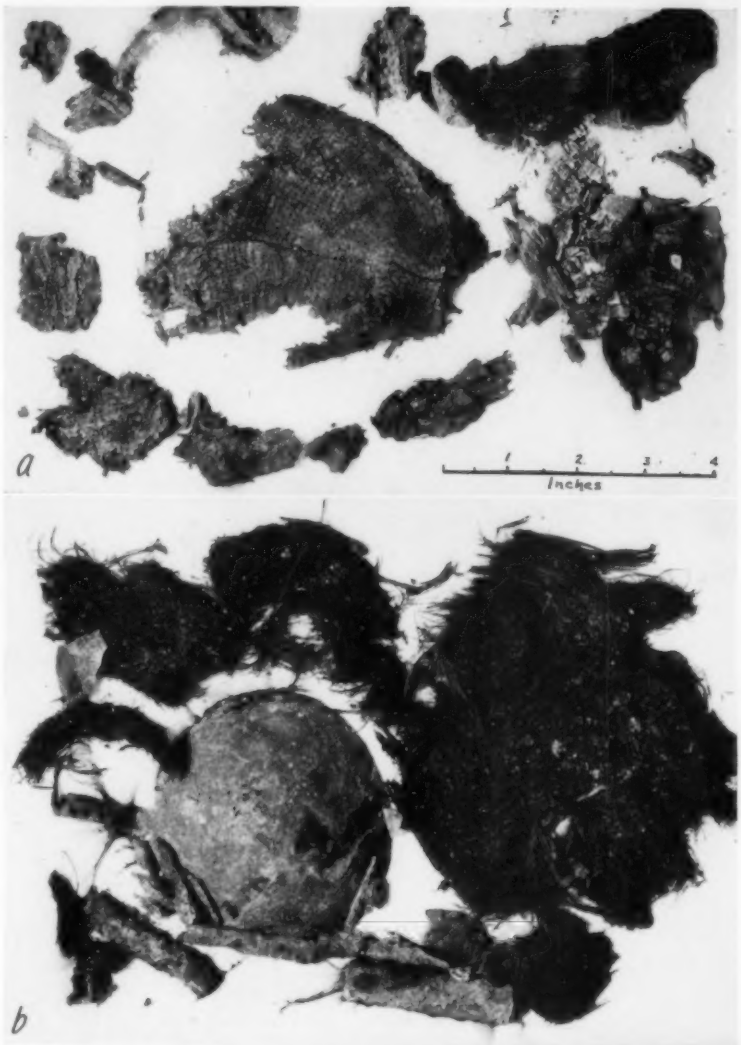
[11] Stewart, T. D. "The problem of the fragmentary human skeleton." Proceedings of the 8th Annual Meeting American Association Physiological Anthropologist, *American Journal Physiological Anthropology*, XXII, No. 3, Supplement, Abstract 14, 1937.

[12] Stevenson's formula: $\frac{A+2B+3C}{3}$; where A is % small, B % medium and C % large.



a. Fragments of cloth and fibre mat preserved by contact with the copper discs illustrated in Plate V, *d*. *b*. Scalp preserved by contact with large copper discs, from ossuary.

Pathological bone and three views of a male cranium from the ossuary. (*Photographs of bone, by Alice L. L. Ferguson, of cranium, by U. S. National Museum.*)

Locality	*Ear exostosis* %	*Perforation tymp. plate* %	*Sept. apert. humerus* %	*Third troch. femur* %
New York:				
Various	—	—	20.4	—
New Jersey:				
Minisink	(*Infrequent*)	15.1	21.4	19.7
Maryland:				
Port Tobacco	2.7	16.4	24.4	32.6
Anacostia	3.4	11.9	27.0	32.2
Accokeek	3.2	19.4	33.0	37.2
Piscataway	**2.8**	**17.0**	**26.1**	**26.3**
Virginia:				
Potomac Creek	1.6	19.9	23.2	20.2
Western	10.2	11.0	36.5	19.7
Kentucky				
Indian Knoll	22.2	14.4	18.8	26.3

the two sexes by the somewhat arbitrary criteria of size and general proportions. Only maximum length is here reported and that for the purpose of determining stature with the Pearson formula:

	Number	*Length of Femur (cm.)*	*Stature* *cm.*	*in.*
Male:				
Right Femur	31	47.4	170.4	67.1
Left Femur	32	46.9	169.4	66.7
Female:				
Right Femur	25	42.7	155.8	61.4
Left Femur	21	43.0	156.4	61.6

The averages given in this table fall rather close to those of the first Accokeek ossuary, with the exception that some taller individuals are included among the males. The longest femur (male) gives a maximum length of 52.9 cm., which corresponds to a stature of about 6′ 1″. The tallest individual in the first Accokeek ossuary was about 5′ 8″.

Pathology. As usual in the Potomac Valley skeletal remains, the most common pathological changes are dental caries and periostitis (syphilis ?). In the sample of the tibiae presented for examination, periostitis was observed in 11 right and 9 left (Accokeek: 11 right, 20 left). In view of the fact that the Piscataway ossuary is more recent than the first Accokeek ossuary, as evidenced by the presence of trade

goods, it is surprising that more pathological bones were not recovered. I suspect that many such cases were overlooked.

Among the less common pathological conditions encountered were three cases of fracture: 1) Through the neck of the femur in a female; 2) Through the midshaft of the femur in a male; and 3) Through the midshaft of the tibia in a male. In addition there was one femur, the head of which appeared abnormal; but the nature of this condition has not yet been determined.

Miscellaneous. It should be recorded that a number of the long bones show the green stain resulting from contact with copper. On the other hand, no evidence of burning was seen.

Conclusion. Briefly, it is my impression that this skeletal sample differs very little from those of other ossuaries in the Potomac Valley thus far studied. Such differences as have been noted are probably associated more with inadequacy of sample than with true changes in population. In general, the affiliation of this group seems to be with the northeastern dolichocephals.

Washington, D. C.
July, 1939

CONTRIBUTIONS TO OREGON COAST PREHISTORY

KENNETH E. LEATHERMAN AND ALEX D. KRIEGER

NATIVE civilization in western Oregon disintegrated so rapidly under white influence and white men's diseases that only a few traces of it are left. By 1850 most of the native materials had been given up by surviving Indians and replaced by trade implements brought by the whites.[1] It was, therefore, with considerable interest that Mr. Leatherman began excavations in December, 1938, at a small Indian village site at the mouth of Coquille River, Coos County, Oregon. The owner

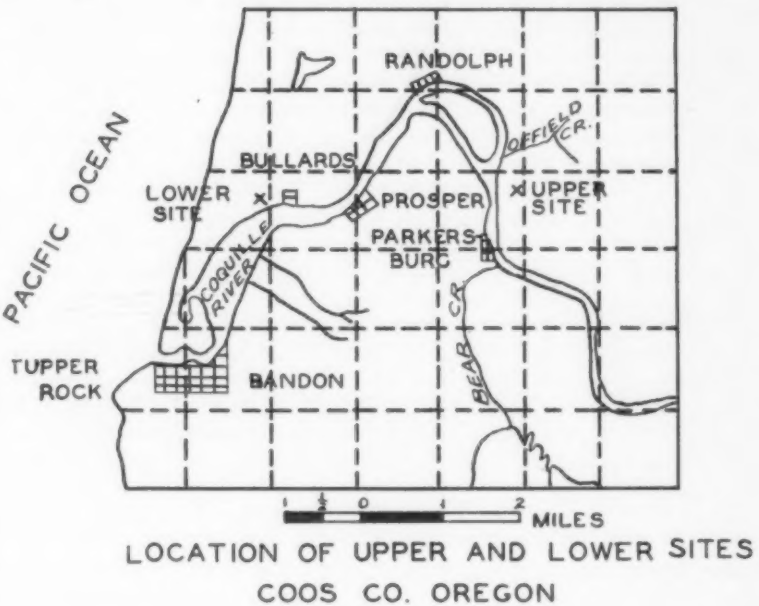


FIG. 3.

of the property, Mr. Warren Bullard of Bullards, Oregon, stated that this village had been occupied by Indians during the 1850's when his

[1] The earliest foreign influence in this area was perhaps the southward trek of Russian and Aleut sea-otter hunters shortly after 1800, but of this there is no direct evidence in our excavations.

grandfather had settled on this property. Thus there seemed an excellent opportunity to obtain here artifacts of types associated with native culture before its complete decay (at least in the material sense) under white influence. The artifacts which were recovered from this and another site four miles upstream (see Figure 3) are thus doubly important since they give us concrete examples of objects mentioned but not actually obtainable by present day ethnographers.

University of Oregon students formed the "man power" during four days excavation in one of the native house pits (House 1). Work was carried far enough to determine the house dimensions and all artifacts removed from within it. Three burials were recovered from just outside its northeast wall. Three months later, in March, 1939, another party of students, including both authors, returned to the spot and completely excavated House 2, a few feet west of House 1. Parts of a third structure (House 3), either a house smaller than the other two, or perhaps a shed, were traced still farther to the west (Figure 4*a*). The two excavations, therefore, yielded data on native structures, while in and around them about 150 artifacts, largely of bone and antler, were recovered. After the first three, no further burials were discovered.[2]

In addition to these excavations, notes were made on the fine private collection of Charles and Mollie Fahy of Bullards. Besides several undoubtedly original Coos baskets (authentic ones are extremely rare) this collection contains quantities of beautifully flaked points. Many of these are small and in all probability for arrows, while others may be for spears. Large numbers of arrow points are also found to the south in Curry County. Obsidian seems to be totally absent from this region, the points being made of flints and cherts in various colors. The presence of these points is significant because written records of native culture here mention bone, but not stone, arrowheads. The Fahy collections also contain several very typical Yurok adze handles of local schist, a material found at Tupper Rock (see map, Figure 3). This would indicate that these finely shaped implements were made here. The very nicely made adze blades (Plate VIII, *1*) found along the Coquille are also apparently made of the Tupper Rock schist.

Upon completion of the work, the artifacts collected were shown to Mrs. Ida Mecum of Bandon, one of the three or four surviving pure-

[2] Dr. L. S. Cressman kindly arranged for funds from the Museum of Natural History, University of Oregon, which helped defray expenses on both trips. The students personally met the balance. Many thanks are due Mr. and Mrs. Warren Bullard for continual coöperation at the site.

blood Lower Coquille Indians.[3] She offered information of ethnographic interest, as well as comments on the artifacts which will be used in describing them below. It is obvious, however, that living Indians are not acquainted with the details of most really native implements, even though they retain memory of many customs.

THE BULLARD SITE

The two or three houses discovered here were probably built on the crest of a low, irregular sand dune. The site is on the north (tidal) shore of Coquille River about 600 yards west of the Bullards ferry and post office, which is three miles north of Bandon (see Lower Site, Figure 3). The only distinctiveness of this dune from hundreds of others is its proximity to a tiny fresh water seep. After the houses were built upon this dune, they were lived in long enough for a cap of midden (broken shell, animal bones, ash etc.) about two feet thick to gather on top of the sand that had been heaped up against the house walls. This midden was concentrated on the river-beach side of the houses, and in the ten foot space between Houses 1 and 2. Some of it of course accumulated within the houses as well (see Figure 4*b*). All the artifacts discovered came from these three main midden concentrations. A test pit below the floor of House 2 revealed a thin layer of charcoal and shell about three feet below this floor and separated from it by sterile yellow sand. Apparently the dune had been a camping place some time before the houses were built. No objects came from this stratum.

To all intents and purposes, the objects collected at this site represent a single occupation of undetermined length, but probably all within a few years in the middle of the last century.

Houses. The three structures lay on a common axis from northeast to southwest, roughly parallel to the river bank at this point. All lay about 50 feet back from high tide line, and about 10 feet higher. Each was constructed over a pit some 3 feet deep, and, in Houses 1 and 2, 12 to 15 feet on a side. Walls consisted of cedar planks mounted horizontally. No remains of any of these structures jutted more than a foot out of the sand, and it was impossible to determine where the doorways had been. From what we can reconstruct, each of the three structures was a separate building consisting of a single room, with a flat floor and no internal terraces. There were no definite fireplace depressions or rings. There were no signs of plank flooring. Two stakes in the northern corner

[3] She was a linguistic informant for Dr. Melville Jacobs of the University of Washington four or five years ago.

of House 2 may indicate a rack or bunk of some kind. Other stakes in Houses 1 and 2 were braced with rocks, and still others may have served to brace wall planks.

House 3 may have been a shed or storage place. There was much animal bone and broken shell within it, but little ash and no artifacts. It seemed distinctly smaller than the others, and lay at the mound edge.

Mr. Bullard informed us that bark roofs were used. He had not seen or heard of plank roofs, but these are reported for the Coos and other Oregon coast peoples by Barnett.[4] A square post in the center of the northeast side of House 2 indicates a ridgepole support; if so, the house ridge closely paralleled the river.

No wall could be traced along the northeast side of House 1. Since this is the leeward side, possibly no wall was necessary for protection. Perhaps, however, its absence is connected in some way with the three burials (see below) on this side. In contrast to the other three sides of this house, only sterile sand lay on this side.

Whalebone. A great many chopped and split pieces of whalebone were scattered over most of the site. Many of these appear to be the whittlings from some manufactured objects, though none of these were found, unless a half dozen flat pieces cut into rough rectangles are to be regarded as plates of some kind. There were, however, three notable concentrations of whalebone chunks; one on the floor, one in the cache at the northwest corner, and another outside the southeast corner, of House 2. Perhaps these had some sort of magical significance.

Caches. Several pointed bone objects of unknown use (Plate VIII, *7, 8, 20, 23, 24*) and a large section of whale rib cut square at both ends lay in a small cache pit at the northwest corner of House 2. A number of elk antler wedges and whalebone chunks lay in another pit in the southwest corner of House 1. In both cases the pits apparently were dug under the bottom wall planks, which were not sunk beneath the floor surface.

Burials. The three burials, numbered in the order excavated, lay outside House 1 as shown on Figure 4*a*.

Skeleton 1, that of a mature adult male of medium build, lay in extended position on the back, with head to the southeast or toward the river. The hands lay on the pelvis. Some missile, probably a bullet, had passed through the skull in two places. The skeleton was covered with remnants of a cedar plank and lay about 18 inches below the

[4] H. G. Barnett, "Culture Element Distributions: VII, Oregon Coast"; *University of California, Anthropological Records*, volume 1, 155–203, 1937. Elements 1–65 deal with details of plank structures.

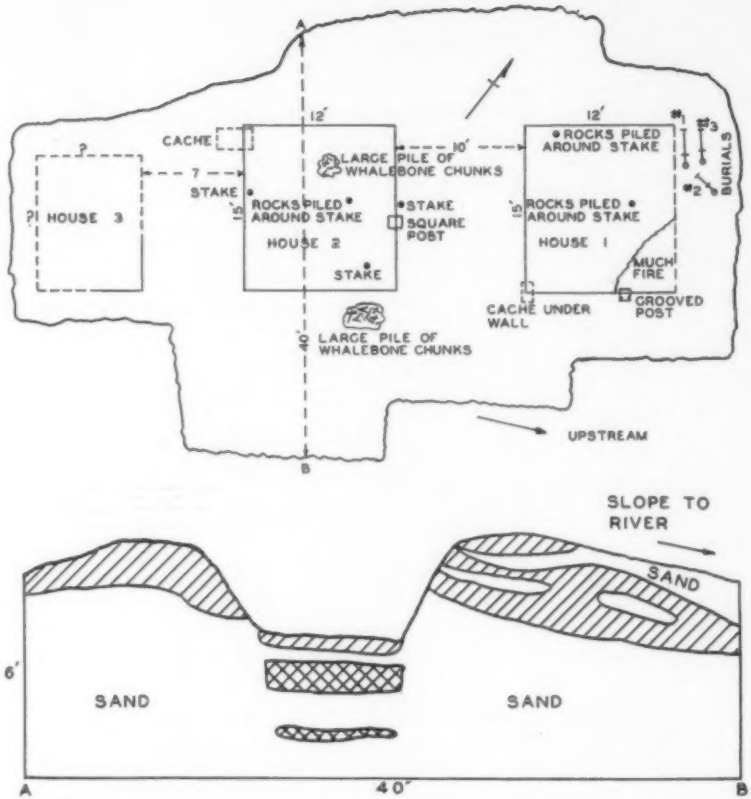
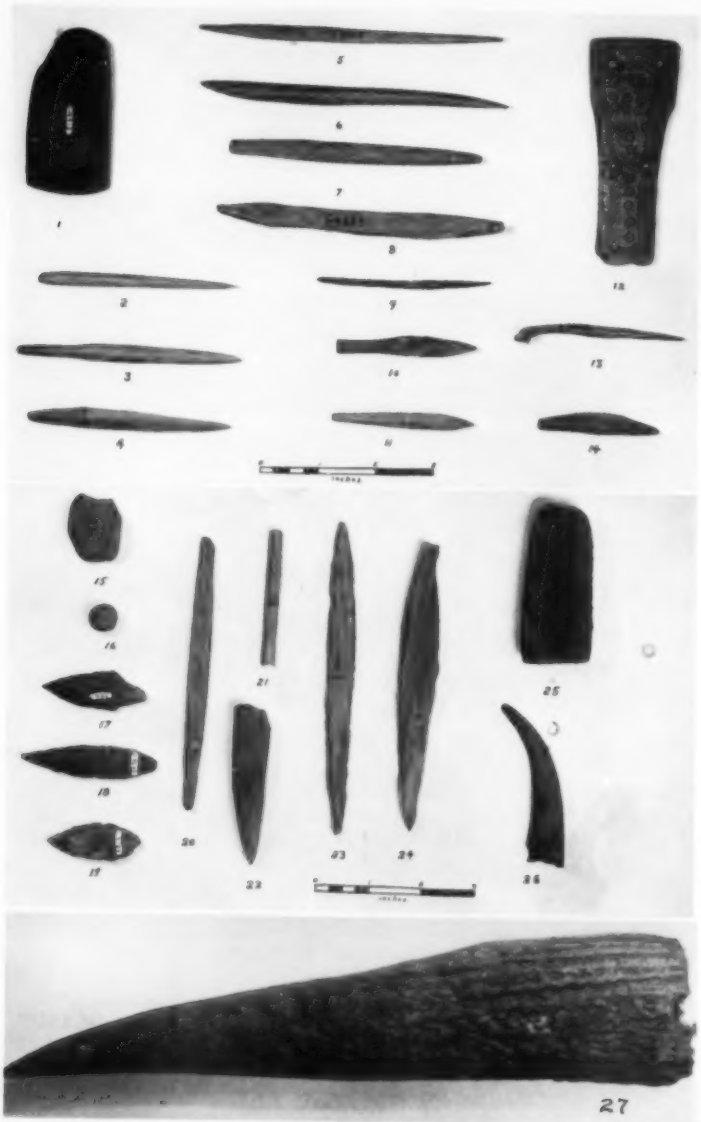


FIG. 4.—*a*. Approximate ground plan of three structures excavated at the Bullard site. Wavy line circumscribes the area excavated. *b*. Cross-section of the Bullard site along line AB of Figure 4*a*. Cross-hatch denotes pre-house refuse lenses, probably in pits dug in dune. Shaded area denotes midden (ash, shell, animal bone) associated with houses and containing artifacts. Blank areas are sand. Vertical scale exaggerated.



No. *1* small adze from river beach, gift of Mr. and Mrs. Bullard; nos. *2–14* and *20–27* are from the Bullard site, nos. *15–19*, from the Schwenn site.

present surface of the sand; the amount of sand covering may have shifted considerably since the burial. There were no artifacts.

Skeleton 2 is that of a small sub-adult female (?) with lower third molars just erupting. Like skeleton 1, it was about 18 inches deep, extended on the back, and had been covered with one or more cedar planks. It differed from the other burials slightly in lying at a 45 degree angle with the house wall, the head being nearly due east. There were no artifacts. The whole skeleton was badly decayed.

Skeleton 3 lay parallel to skeleton 1, 2½ feet farther from House 1, and at about the same level although only 5 inches of sand covered it. It, too, was covered with a plank, extended on the back, and lay with head toward the river. It is the skeleton of a young but mature female. The right femur measures 16 inches, indicating a stature of slightly less than 64 inches.

Due to the naturally wet climate of the coast, decay was well advanced in both bones and planks. It is rather remarkable that the planks should be preserved at all, after 80 years. Regarding the human bones, 80 years would not ordinarily cause much decay in some climates; here it may indicate that we will never be able to recover human bones of any antiquity along the damp coast.

It is impossible to gather any measurements on the physical type of these three skeletons. So far as can be seen, the skull fragments do not show any artificial deformation, though this could be expected along the central Oregon coast.

With skeleton 3, the young adult female, were about 75 pine-nut beads, evidently from *Pinus sabiniana*, the common Gray or "Digger" pine of northern California. The three most probable sources of these nuts are the Klamath-Trinity (Hoopa Valley), the upper Sacramento, and the Pit river canyons. The first is the nearest to the Coquille country and about 175 miles away. Trade in these nuts, or beads made from them, was very extensive in northern California and reached well into Nevada and Oregon; commonly the beads were used by women to decorate deerskin or fiber "aprons."

Artifacts. Space does not permit detailed description of the several distinct types of bone, antler, stone, and shell artifacts. Plate VIII illustrates the most outstanding forms, for each of which there are in most cases several examples and variants. As stated above, all the materials from the Bullard site, including numbers *2–14* and *20–27* of Plate VIII, are to be regarded as contemporaneous and datable at *circa* 1850.

Briefly, the Bullards artifacts are as follows:

Material—General character	*Number found*	*Number on Plate VIII*
I. Bone		
A. Leg or "cannon"		
1. Bi-pointed barb or point for heavy harpoon (?); thicker end triangular in section	1	*6*
2. Bi-pointed pin; one end tapers abruptly about 1" from tip; slim in proportion to length	3	*5*
3. Bi-pointed pin like above, but notably thicker	2	*3*
4. Pin, bi-tapered but ends blunt	1	*7*
5. Pin, bi-tapered but one end sharp, other end smoothed off round (centerpiece for fish harpoon toggle head?)	1	*2*
6. Similar to 5, but cruder workmanship	2	*4*
7. Barb for fish harpoon toggle head, grooved to fit snugly against side of centerpiece like 5 (above); out-turned tip acts as barb	3	*14*
8. Pin, bi-tapered from place near one end—*i.e.*, steep to one tip, gradual to other; round	1	*11*
9. Pin, similar to 8 (above) but thickest part farther from sharp tip, flatter in section, and butt expands slightly	3	*10*
10. Very thin bi-pointed pin (a fish gig?)	1	*9*
11. Crude bi-pointed object (cf. 35, below, of antler and Plate VIII, *23*)	1	
12. Large bi-tapered object, crude, ends blunt, (cf. 35, below, and Plate VIII, *20*)	2	
13. Bone splinters, crude, but one end smoothed to sharp point (awls?)	8	
14. Like 13 (above) but larger and of elk tibia	3	
15. Large "dagger" of elk ulna, articulation surface of natural bone forming handy grip	1	
16. Chisels or shell-pries, crude except for flat smoothed tip	2	
B. Animal rib		
17. Small ribs smoothed to wide, thin point	2	
C. Fish rib		
18. Like 17 (above) but ribs naturally narrower and hence point long and thin like an awl	2	
19. Whole rib of salmon (?), serves as awl-like implement with slight sharpening of tip	10	*13*
D. Bird leg		
20. Whistle, with one square stop exactly in middle and incised "herring bone" design on both top and bottom. Lengths: 2⅛" (illustrated) and 4¼"	2	*21*
21. Beads. Length: 1⅛" and 2⅛"	2	
E. Whalebone		
22. Rectangular flat platter (?) from vertebra ramus (?); 10"×6"×1" thick	1	
23. Section of rib or ramus, cut square at ends and edges adze-fluted (as design?)	1	
24. Oval section of rib from its small end, ends squared; length 27", diameter 4½". Found in cache under NW wall of House 2 (might have been used as drum to attract whale?)	1	
F. Elk skull		
25. Top part of elk braincase with antler stubs included; face and occipital parts chopped off; groove hacked longitudinally along top between antler stubs. Mr. and Mrs. Bullard have four or five like it. (Possibly the remains of elk-decoy headpieces?)	1	
Total, bone	57	
II. Antler (elk and/or deer)		
26. Wedges and/or chisels of antler shaft *split* longitudinally and		

Material—General character	*Number found*	*Number on Plate VIII*
smoothed all over. Butts squared and hammered. All are straight, the longest 5½″, shortest 3½″. Incisions on one	8	
27. Also wedges and/or chisels but antler used in round and beveling all on one face in one direction. Shaft straight or slightly curved and butts as above. Longest 8½″, shortest 4″	14	*27*
28. Curved shafts, with rather square working edges, so probably chisels or at least used in the hands. Butts square, not hammered. Longest 10½″, shortest 7½″	7	
29. Tines, not certainly artifacts and may be tips lopped off in working shaft sections	6	*26*
30. Small chisel (?) with squared cutting edge	1	*22*
31. Long, curved tine with sharp point; crotch end left as knob for gripping. Probably a prying tool or clam digger. Length 18″	1	
32. Tine worked into bi-tapered crescentic object, round section. Natural tip forms one end, other whittled down to match it in size and curve. Length 4½″, max. thickness ¾″	1	
33. Nondescript pieces of whittled antler	2	
34. Flat piece, beveled at ends by whittling (instead of by grinding as in bone objects, above)	1	*8*
35. Other pieces, bi-tapered by whittling	3	*20,23*
36. Crude splinters, sharpened by grinding as in group 13 (above, of bone).	2	
37. Object, probably broken part of wedge, cut around butt so as to leave knob	1	*24*
38. Similar to 37, fragment	1	
39. Long slender pin, scraped fairly smooth and in round section except toward end, where the section becomes oval. Possibly a flaking tool but fragile for this. Diameter 5/16″	1	
40. Flat pendant (?), polished and decorated on surface shown but rough and plain on back. Thickness uniform at 3/16″. Five perforations: three at broader end, two near center; lines and circles incised	1	*12*
Total, antler	50	
III. Stone		
A. Cherts		
41. Small "thumb-nail" or "snub-nose" scrapers	3	
42. Scrapers, larger than above, "turtle-back."	2	
43. Spall scrapers, sharpest edge slightly improved by minute flaking	5	
44. Hammerstone, fractured all around	1	
B. Various river stones		
45. Hammerstones	3	
46. Choppers, with rough chipped edges	2	
47. River pebbles showing polishing from use, probably for rubbing and softening skins (Mrs. Mecum says stones used for this)	5	
48. Possible grooved club head	1	
49. Possible ungrooved club head	1	
C. Schist		
50. Rectangular, flattish piece much like adzes in local collections, but ends thick and blunt, not as for cutting	1	
51. Fragmentary flat piece of schist, reduction of width very much as in antler object 40 (above, and Plate VIII, *12*) but twice its size and not perforated or incised	1	
D. Misc.		
52. Nondescript stone, possibly clay, fired so hot its entire surface is webbed with cracks	1	
53. Grooved sandstone arrowshaft wrench	1	*25*
54. Net sinker, spherical, diameter 3″, one encircling groove	1	
Total, stone	28	

Material—General character	*Number found*	*Number on Plate VIII*
IV. Shell*		
55. "Keyhole Limpet" (*Glyphis aspera*). Bead	1	
56. "White Cap Limpet" (*Acmaea mitra*). bead	1	
57. A disk, diameter 1″, irridescent on one side, cut from valve of "Smooth Jingle Shell," an oyster of *Anomia* sp. May have served as inlay in some wooden object	1	
58. Whole shell of "Purple Hinge Pecten" (*Pecten Hinnites Giganteus*), stained as though used for oil (?) receptacle	1	
59. Whole shells of "Otter Shell" clam (*Lutraria Maxima*) and "Cockle Shell" (*Cardium* sp.). They could have been cups or oil receptacles	2	
Total, shell	6	
V. Wood		
60. Bi-pointed pieces, length 4½″ and 3½″, too decayed to determine exact shape	2	
61. Claw-shaped piece, point sharpened, butt squared, length 2½″, diameter ½″	1	
Total, wood, not including house pieces or burial coverings	3	
VI. Copper		
62. Pendant, truncate triangle in shape; width at top (perforated) end ½″, at base 1½″; length 2½″, about as thick as heavy paper	1	

* Shells kindly identified by Dr. Warren D. Smith, Professor of Geology at the University of Oregon.

In capitulation, the frequency of material recovered, together with the number of items described for each material, is as follows:

Material	*No. specimens recovered*	*No. of descriptive classes (above)*
I. Bone (A–F)	57	25 (1–25)
II. Antler	50	15 (26–40)
III. Stone (A–D)	28	14 (41–54)
IV. Shell	6	5 (55–59)
V. Wood	3	2 (60–61)
VI. Copper (from whites)	1	1 (62)
Total	145	62

The category of "Wood" cannot of course be taken seriously, for it was only good fortune that we recovered any objects of this material at all. No doubt a good many objects of wood were made by the natives as this was available on every hand. House pieces and burial planks presumably had not completely decayed because of their bulk and thickness, whereas smaller objects could not have lasted unless of hard wood.

Absences. It is worth remark that several classes of objects which could be expected at the site on the basis of ethnographic reports, were not found. This could be due to matters of chance, to the giving up of

some practices with material attributes by the year 1850, or to some real cultural lacks. At any rate, the most conspicuous absences are: projectile points of stone, stone adzes,[5] stone mauls for driving wedges, grinding implements (either basket mortar or bowl mortar), pestles, stone or pottery pipes. Some of these traits were noted in connection with the Upper Site on the Schwenn farm, under circumstances that point to notably greater age at the latter place.

UPPER SITE

This is a shell mound on the property of H. H. Schwenn, between four and five miles up the Coquille from Bullards and on the east side of a northward bend of the river. The site was only superficially examined by Mr. Leatherman in December, 1938, and about 30 specimens recovered from several shallow test pits. The importance of this site as a cultural contrast to the Bullards site was not apparent until after the latter had been excavated. Work should be continued and the relation between the two places determined. There is good indication that, so far as archaeology can reveal, distinct differences in time as well as material culture mark these two sites. It may be asked why the Schwenn site should have been established five miles farther inland than the other; this too may have something to do with their relative age.

The objects from the Schwenn site may be regarded as contemporaneous, and include the following features: (only those with an asterisk have counterparts in the Bullard site collection)

1. Fragments of two stone mortars of the bowl variety and apparently globular. One was about 5″ high, with a bowl 3″ deep and about 3″ across; the material is sandstone. The second was considerably larger than the first, but its dimensions are not ascertainable; the material is metamorphic rock.
2. Eight stemless leaf-shaped points, crudely flaked, of gray and reddish cherts, of the type shown in Plate VIII, *18* and *19*, which are the largest and smallest of the eight found.
3. Two or three stemmed, lozenge-shaped points of the type shown in Plate VIII, *17*, material and workmanship similar to the above.
4.* Four crude choppers or hand knives of quartzose material.
5. Fragment of reddish sandstone tubular pipe (Plate VIII, *15*). It is possible that this material is pottery without temper, for the Fahy collection contains several pipes undoubtedly of pottery.
6. A small almost perfectly round sphere of yellow marble (Plate VIII, *16*) which may be an unfinished bead. The Fahy collection contains several such balls perforated for suspension.
7.* Two small antler tips, partly permineralized.
8. A perfect bone awl of longitudinally split cannon bone of a small deer, the round distal tip of the bone remaining as the butt. Length 6¼″.

[5] It is probable that many of the antler implements found here served for chiseling wood. Still, it is odd that we recovered no certain adzes, especially in view of the amount of woodworking on the spot indicated by the many wedges. Too, the Warren Bullards have picked up at least a dozen very fine stone (schist) adzes, as that on Plate VIII, *1*, along the river beach near the village site.

9.* A small tapered bone object similar to Bullards, items 5 and 6 (Plate VIII, *4*).
10. Four well made chisels or adzes of cannon bone, which apparently were burned to harden their edges (and thus made adzing edges about as good as stone), and later became permineralized. They are heavier than natural bone and quite hard. The only complete one is 3½" long, 1½" wide, and has a straight cutting edge 1" wide.
11.* One small antler wedge, the shaft having been split in half and the wedge smoothed over all, as in Bullards item 26.
12. One long polished bird leg bone, incomplete.

Items 4, 7, and 11 provide slim affiliation between the two sites. Item 9 may be slightly more significant, but it is simple and its use unknown. The contrast at least indicates that materials are available for important archaeological work along this coast. It is mainly the partial permineralization of the bone chisels or adzes at the Schwenn site that makes the materials here look older than those at the known historic site at Bullards. The leaf-shaped projectile points support this view, for they in all likelihood are not arrowpoints.

It is interesting, too, that both the Fahys and the Bullards have picked up a great many artifacts along the tidal beaches of Coquille River that do not agree at all well with the historic site at Bullards, but do show better agreement with the probably pre-historic site at Schwenn's. The only thing sure as yet is that more work in such places will yield more tangible evidence of changes in material culture along this coast.

We hope in the near future to make better inventories of the many interesting objects to be found in private collections along this coast. Materials abound and the great bulk of such collections as those of Charles and Mollie Fahy have been gathered simply by walking the tidal beaches and picking up specimens. Excavations, however, should give us badly needed temporal factors.

University of Oregon
Eugene, Oregon
June, 1939

STATISTICAL CLASSIFICATION[1]

A. L. KROEBER

I PRESENT herewith four-cell coefficients calculated from data given in two recent midwestern archaeological reports by Webb and Griffin.[2] The purpose is not controversial, since in a simple situation involving a small number of culturally related sites a competent archaeologist saturated in his material can draw all important classificatory inferences and it would be vain to hope that any statistical device would add anything fundamental. What calculations can do in such a case is this: (1) Check errors and oversights of "intuitive" or inspectional interpretation. This of course holds both ways: if there is serious disagreement, a computatory error may be at fault. (2) Present results with added clarity and incisiveness, especially after numerical coefficients have been translated into diagrams. (3) Indicate minor revisions of classification. (4) Sometimes suggest the factor at work if a classification comes out conflicting or dubious at certain points.

Like any other inductive comparison, a statistical one, *per se*, of course yields only a classification. How this is to be read in terms of cause or sequence is a subsequent and non-statistical matter.

The usual statistical approach to culture material is through traits or elements, on which archaeologists, ethnologists, and linguists have come to depend more and more as the evidential basis of comparisons. In fact, of the three groups, archaeologists are perhaps the most familiar with the trait concept. A trait can be determined as occurring or not occurring—present or absent—in any given cultural manifestation. If it seems to be ambiguous, it can usually be broken down into two or more traits, which can then be successfully described as present or absent.

In anthropometry as the name implies, it is customary to measure on a scale. The present-absent or four-cell method of statistics has therefore been little used and is generally not even taught in anthropometry: measures of mean, variability, and correlation take its place. In all fields of culture, however, experience has shown scale measurement to be difficult. Either the scale is really subjective and only pseudo-quanti-

[1] Typewriting, computations, and diagram by a University of California W.P.A. project, No. 665-08-3-30, Unit A-15.

[2] Webb, W. S., *An Archaeological Survey of the Norris Basin in Eastern Tennessee.* Bureau of American Ethnology, Bulletin 118, 1938.—Griffin, J. B., *An Analysis of the Fort Ancient Culture, Notes from the Ceramic Repository . . . of the University of Michigan,* No. 1, 1935.

tative; or if quantitative, it seems to miss what we feel to be the significance of culture phenomena. Hence, the falling back on manipulations of presence and absence counts.

When any two cultural manifestations are compared, their trait presences and absences are of four orders or kinds: *a*, present in both; *b*, present in one, absent in the other; *c*, the reverse; *d*, absent in both. In ordinary language, *a* and *d* are agreements, positive and negative respectively; *b* and *c* are disagreements. These are the four "cells" into which the inventory of traits occurring in two culture manifestations are distributed.

The four cell-values are then treated by one of several formulae to yield a coefficient. This coefficient for cultures 1 and 2 is then compared with the corresponding coefficient for cultures 1 and 3, 2 and 3, and so on. From this comparison of coefficients there results a classification of the relative degree of likeness of the cultures dealt with, so far as they are known through evidential data. Each coefficient, of course, is a generalized expression of likeness, which takes on meaning from the relation to other such generalized expressions of likeness.

Some of the formulae are derived by mathematicians interested in statistical theory and enjoy professional repute. Others are commonsense proportions. Experience to date indicates that ordinarily there is not very much to choose between the several formulae as regards their effective representation of the "truth" of the situation.[3] I shall therefore use several different formulae by way of exemplification, without discussing their respective merits.

There is only one more theoretical point to be mentioned. Should common absences be dealt with? Almost everyone at first makes this objection. Why are two nothingnesses significant? Do they not introduce something artificial and unreal? The simplest answer is that given by Driver. If culture 1 has a trait and culture 2 lacks it, everyone will concede that the fact is significant. Therewith, however, we have admitted one zero. Since we all deal with such oneway zeros without qualm, why boggle at double zeros? Of course they must be pertinent to the field of investigation. That is, they must occur somewhere in the area or complex dealt with; otherwise they are gratuitous and may lead to mis-

[3] As my colleague and collaborator, H. E. Driver, has shown, all formulae give more or less misrepresentative results when one or two of the four values *a*, *b*, *c*, *d* differ very greatly from the others, that is, when their distribution is markedly skew. According to the nature of the particular skewness encountered, each coefficient can be specially misrepresentative, speaking broadly.

leading results. If we are comparing sites x, y, and z and none of them has pottery, there is no sense bringing pottery into the trait count. If, however, site z has pottery, the 0–0 relation of sites x and y on this point evidently is significant, precisely because x and z, and y and z, show a 0–1 relation.

Conversely, universal positives are omitted from counts. If all sites dealt with possess pottery, three uniform 1–1 relations add nothing when we are investigating degrees of differentiation and likeness. If the three potteries are identical in all their features, we might in fact add twenty 1–1 relations for twenty pottery traits, swell the values in the a cells, and thereby tend to distort all coefficients more or less.

In practice, common negatives sometimes present a problem, because we do not always know whether a trait was really lacking in a culture or has simply failed to be found in the excavations or collections made. In ethnology and linguistics such risks also occur, but are often more easily dealt with because they are evident, or the situation can be remedied. If the question is whether a given language has or has not a subjunctive, and the author of a grammar on it discusses modes in detail but does not mention a subjunctive, it is reasonably probable that this feature is lacking. But if his grammar is sketchy and he fails to consider modes altogether, it would be rash to infer either presence or absence of a subjunctive. Similarly, in ethnology we can to a certain degree estimate the probability of absences by fulness of context. When ethnologists, through localization of interest, cite almost no trait absences—which by their nature express a comparative point of view—even though they describe in great detail features that are present, it is always possible to retrieve the negative information, and sometimes rather rapidly, by special new inquiries. Our Element Survey in California, for instance, represents to a large extent, though not wholly, just such an endeavor.

With extinct cultures, however, there are corresponding limitations: there may be nothing left of a site, or to repeat an excavation would be prohibitively costly; and on account of perishability, whole classes of objects are ordinarily lost. If one site is favored by exceptional conditions favoring preservation, and has yielded a series of wooden objects, textiles, and the like, it is better to omit these from any quantitative comparison rather than to construe them as jointly absent from the manifestations at the other sites to which the first is being compared. This of course is only common-sense. A similar caution would be exercised as between a cemetery of the evidently wealthy and one of the

poor; though luxury and art objects might become important at a later stage of investigation, in comparisons made between a whole series of related sites and another such series. On the whole, a safe rule seems to be to compare only sites or cultures whose trait inventories are not too disproportionate. If one site has yielded only a tenth as many traits as another, it is evidently an inadequate sample; if it yields half as many, the sample may be reasonably adequate for comparison; just as in anthropometry we would not build heavily on the difference shown by the means of ten individuals measured in one population and a hundred in another, though if there were fifty and a hundred we should feel that the result had fair reliability. After all, it is desirable to avoid pedantic perfectionism: all study of men must rest on sampling. In archaeology, it is perhaps generally wise to make primary comparisons between the more adequate samples, and then tentatively attach inadequate ones—minor sites, the results of incomplete excavation, and the like—to the classification built up on the fuller samples: more on this matter in the concrete analyses that follow.

TENNESSEE

On pages 367–368, Webb gives a table of traits occurring at ten Norris Basin village sites showing post-mold patterns. This table lists seventy-five traits,[4] of which twenty-four relate to house structure. Webb finds that his sites Nos. **2, 4, 5, 6, 8, 9, 17** are of one type, which he calls "small-log," and **10, 11, 19** of another, the "large log." Webb follows his table with a list of forty-five lines, such as: "Sites Nos. **2** and **4** have a total of 46 traits—17 in common, or 37 percent."[5] The values in a list of this sort are hard to conceptualize; and on page 370 he gives a tabular arrangement of percentages which shows that the thirteen highest of the forty-five comparisons (values of 41% or more) are all either between small-log and small-log or between large-log and large-log sites, whereas the fifteen lowest (22% or less) are all between small-log and large-log sites. While this presentation is not particularly incisive, it is convincing enough.

Webb's percentages express the values of the formula $a/(a+b+c)$, with a, b, c the same as in the four-cell table. Thus, for sites **2** and **4**,

[4] Actually only seventy three show variation: two are universal positives (rectangular post-mold patterns, clay floors) and should not have been counted. I noted them as universal only after the computations had been made; but they are too few to affect the coefficient relations materially.

[5] Two of these, **4–6** and **5–17**, seem to have been erroneously counted, either by Webb or by me.

a = 17, b = 22, c = 7, a + b + c = 46. For sites **2** and **5**, the values are 32, 7, 13 = 52.

Adding d, the number of traits jointly lacking at the pair of sites being considered, though occurring somewhere in the group of ten sites, we have, for **2** and **4**: a = 17, b = 22, c = 7, d = 29 (= 75 − 46). As a matter of record, I first list the values a, b, c, d for the forty-five combinations of sites.

2-4: 17, 22, 7, 29	4-17: 18, 6, 22, 29	8-9: 18, 3, 23, 31
2-5: 32, 7, 13, 23	4-19: 10, 14, 25, 26	8-10: 8, 13, 36, 18
2-6: 14, 25, 5, 31	5-6: 13, 32, 6, 24	8-11: 7, 14, 24, 13
2-8: 17, 22, 4, 32	5-8: 19, 26, 2, 28	8-17: 12, 9, 28, 26
2-9: 30, 9, 11, 25	5-9: 32, 13, 9, 21	8-19: 8, 13, 27, 27
2-10: 15, 24, 29, 7	5-10: 24, 21, 20, 10	9-10: 16, 25, 28, 6
2-11: 12, 27, 19, 17	5-11: 19, 26, 12, 18	9-11: 9, 32, 22, 12
2-17: 24, 15, 16, 20	5-17: 29, 16, 11, 19	9-17: 25, 16, 15, 19
2-19: 12, 27, 23, 13	5-19: 19, 26, 16, 14	9-19: 14, 27, 21, 13
4-5: 23, 1, 22, 29	6-8: 11, 8, 10, 46	10-11: 27, 17, 4, 27
4-6: 9, 15, 10, 41	6-9: 18, 1, 23, 33	10-17: 24, 20, 16, 15
4-8: 11, 13, 10, 41	6-10: 8, 11, 36, 20	10-19: 33, 11, 2, 29
4-9: 22, 2, 19, 32	6-11: 5, 14, 26, 30	11-17: 17, 14, 23, 21
4-10: 12, 12, 32, 19	6-17: 11, 8, 29, 27	11-19: 22, 9, 13, 31
4-11: 10, 14, 21, 30	6-19: 6, 13, 29, 27	17-19: 19, 21, 16, 19

I will now apply to these counts two formulas of the several available. The first is R_{hk}, which has theoretical standing.

$$R_{hk} = \frac{ad - bc}{\sqrt{(a+b)\ (a+c)\ (b+d)\ (c+d)}}$$

The values obtained lie between 1.0 and −1.0.

The forty-five coefficients are best presented not in the accidental order in which the ten sites were numbered, but according to a plan which places together the sites whose intersite coefficients are highest, that is, which are most similar. The best arrangement can be found by inspection or a trial or two. This arrangement throws the higher values along a diagonal from upper left to lower right corner of the crossway table. The lowest values will then tend to cluster in the two other corners.

TABLE 1: R_{hk} VALUES

	5	2	9	4	8	6	17	11	10	19
5	1.0	.47	.41	.50	.39	.10	.27	.02	−.13	−.11
2	.47	1.0	.47	.26	.36	.25	.17	−.22	−.43	−.33
9	.41	.47	1.0	.51	.39	.46	.17	−.43	−.44	−.28
4	.50	.26	.51	1.0	.27	.19	.30	.01	−.12	−.07
8	.39	.36	.39	.27	1.0	.39	.05	−.10	−.26	−.11
6	.10	.25	.46	.19	.39	1.0	.05	−.18	−.20	−.18
17	.27	.17	.17	.30	.05	.05	1.0	.25	.03	.18
11	.02	−.22	−.43	.01	−.10	−.18	.25	1.0	.49	.41
10	−.13	−.43	−.44	−.12	−.26	−.20	.03	.49	1.0	.68
19	−.11	−.33	−.28	−.07	−.11	−.18	.18	.41	.68	1.0
Traits present	60	39	41	24	21	19	40	31	44	35

The second formula is a common-sense or simple proportion one: $Z=(a-b-c+d)/(a+b+c+d)$; or $(a+d)-(b+c)$ divided by N; verbally, shared traits less diverse traits, the difference being divided by the total number of traits dealt with. The limits of the values obtained again are 1.0 and −1.0. The arrangement of coefficients is as before.

TABLE 2: Z VALUES

	5	2	9	4	8	6	17	11	10	19
5	1.0	.47	.41	.39	.25	−.01	.28	−.01	−.09	−.12
2	.47	1.0	.47	.23	.31	.20	.17	−.23	−.41	−.33
9	.41	.47	1.0	.44	.31	.36	.17	−.44	−.41	−.28
4	.39	.23	.44	1.0	.39	.33	.25	.06	−.17	−.04
8	.25	.31	.31	.39	1.0	.52	.01	−.01	−.30	−.07
6	−.01	.20	.36	.33	.52	1.0	.01	−.07	−.25	−.12
17	.28	.17	.17	.25	.01	.01	1.0	.01	.04	.01
11	−.01	−.23	−.44	.06	−.01	−.07	.01	1.0	.44	.41
10	−.09	−.41	−.41	−.17	−.30	−.25	.04	.44	1.0	.65
19	−.12	−.33	−.28	−.04	−.07	−.12	.01	.41	.65	1.0

It is evident that while the particular values differ in the two tables, the *relative* values of the forty-five coefficients come out much alike.

Graphically, the results can be presented effectively by symbols each covering a certain range of coefficients. Figure 5 will be self-explanatory

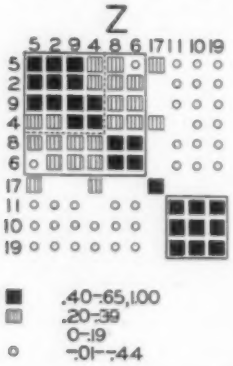


FIG. 5. Graphic presentation of Z values.

with its key. It groups the Z values of table 2, and thus puts no strain on the memory as the eye passes from one part of the table to another.

Now on comparison of either table or the diagram with Webb's classification, it is evident that they largely corroborate each other. Sites **11, 10,** and **19,** Webb's large-log sites, form a clearly marked-off class. They show rather high positive coefficients with one another,

prevailingly negative coefficients with the remaining small-log type sites. "High" does not refer to any absolute value, such as .40, but high in relation to the majority of coefficients in the table. If a group of extremely similar sites were examined, .40 might be a low coefficient. If the sites were very diverse, the table might not contain a single .40, and any positive coefficient would be a high one. For this reason there can be no rule about the range of values to be denoted by one symbol in the graphic representation. One is free to choose as many or as few symbols as one likes, and to assign to each any value-range that will best bring out the salient lines of the grouping.

It will however be noted that one site, No. **17,** does not fall clearly into the small-log group. By both formulas it has no negative coefficients and no first-order positive ones. By R_{hk}, for instance, its coefficients with the six small-log sites range from .30 to .05, with the three large-log ones from .25 to .03. This is not very decisive as to affiliation. Here then I differ from Webb: site **17** is intermediate between his two types, with only slight leaning one way.

Next, it is observable that the six remaining small-log sites segregate into two sub-classes. Sites **5, 2, 9, 4** form a compact group, with high coefficients *inter se*, only one falling below .39 by Z. Sites **8** and **6,** however, average lower coefficients with these four; one of them, according to Z, even is negative.

However, these two aberrant small-log sites are also those which yielded the smallest number of traits present: twenty-one and nineteen, respectively. Their *d* is consequently the highest of any: 46. It seems reasonable to infer that their partial deviation from "standard" small-log type is due to this paucity of material, and that if the two sites had been richer, their inventory would have proved to be typically small-log.

Following up this point of paucity of material recovered, we find that the next most meager site is No. **4,** with twenty-four positive traits, and that it is this site which shows the lowest coefficients within the **5-2-9-4** cluster. The next meager site is **11,** with thirty-one positive traits. This is in the large-log group, but yields lower coefficients with its fellow members **10** and **19** than these have toward each other; also, its coefficients with the small-log group are less consistently negative.

We can infer therefore that, *in this case,* trait inventories of about thirty traits begin to be slightly inadequate as samples of the culture which they represent, and when they fall to around twenty they are definitely unsatisfactory. They still suffice to indicate *probable* adhesion to a class, but not with the degree of conviction of a site which has

yielded thirty-five or more positive traits. These values of course are not absolute, but are empirically derived for this case alone.

Returning now to our "intermediate" site, **17,** we find that this has a full complement of forty traits. Consequently the indecisiveness of its coefficients can be construed as presumably due to a real ambiguity of its cultural position.

While we have in this way obtained a classification mainly corroborative of Webb's, the figures cannot tell us which of the two culture types is earlier. This must be determined from other evidence—stratigraphy, greater similarity of one type to a known historic culture, or the like. Webb has made an attempt to secure such evidence. On pages 371–374 he compares two of his large-log sites, **10** and **19,** with four sites or groups of sites attributed to the Cherokee and explored respectively by Harrington, Thomas, Heye (Nacoochee), and Lewis, using a presence and absence table of sixty-two traits.[6] He finds the results "unsatisfactory," and the connection with the historic Cherokee "not definitely established."

Of Webb's sixty-two traits, thirteen are universal positives. On omission of these, there remain forty-nine. I have calculated from these as before, but leave out site **10** because the positive inventory is considerably smaller than that of all the others. I omit also the Lewis group of which Webb says that it "possibly may represent Cherokee" culture.

The four-cell values are:

H-N: 31, 11, 4, 3
H-T: 27, 15, 4, 3
H-19: 21, 21, 7, 0
N-T: 23, 12, 8, 6
N-19: 20, 15, 8, 6
T-19: 20, 11, 8, 10

From these we derive the Z values:

	H	N	T	19
Harrington	X	.39	.24	−.14
Nacoochee	.39	X	.18	.06
Thomas	.24	.18	X	.22
Webb 19	−.14	.06	.22	X

These figures show at once that site **19** is more different from the known Cherokee sites than these differ from one another. Accordingly, Webb's hesitation to construe his large-log sites as Cherokee is justified.[7]

[6] Webb says, page 372, that this list includes traits occurring at two or more of the six sites; all traits occurring on only one site having been eliminated "as having no value in this comparison." The last phrase may be doubted. He is not trying to prove similarity but to establish degree of similarity, and on this degree, unlikenesses, even if unique, certainly have a bearing.

[7] They might, of course, be prehistoric Cherokee, from a time when Cherokee culture had not yet attained its historic form.

The one exception is the Thomas sites. Their coefficient with site **19** is about equal to those which they have with Harrington and Nacoochee. A reason for this irregularity is however apparent. Thomas failed almost wholly to report on pottery traits, as was customary in his day. Webb therefore visited his sites in 1934 and made a collection of sherds. The 18 ceramic traits of the "Thomas" list are therefore really Webb-secured traits, like those of the site **19** list. These eighteen traits are distributed thus: 10, 3, 0, 5; yielding a Z of .67! It is this Webb ingredient of Thomas which has produced the exceptional high **19**-Thomas coefficient. The non-ceramic Z of **19**-Thomas is only −.03, which does not differ seriously in import from the **19**-Harrington non-ceramic Z of −.29 and **19**-Nacoochee of .10. In short, the apparent exception of the Thomas sites is dissolved, and Webb is confirmed in his conclusion that his large-log sites in Norris Basin cannot yet be positively equated with known Cherokee culture.

This case illustrates two points of method.

First, archaeologists do not yet collect or describe quite uniformly. There appears to be a personal equation sufficient to affect the inventory of a trait list.[8] The moral is that no calculations or comparisons are better than the excavations and typology underlying them are accurate and reliable.

Second, the case may serve to reassure those who fear that once statistics are embarked on, there is no stopping even if they lead to nonsense. Intelligence is of course needed whether one does or does not use statistics, and equally so. Statistical method is a tool, not a mechanical substitute for thought. In the present instance it has served as a means of analyzing out discrepancies in the primary data.

FORT ANCIENT

Griffin's analysis of Fort Ancient aspect sites—four in Ohio, one in Kentucky—is summarized in a folded-in sheet of convenient diagrams. He lists forty-nine non-pottery traits which occur at all five sites. These traits I omit. There remain seventy-four non-pottery traits which occur at from one to four sites. Griffin's pottery traits are not listed as simply present or absent, but as abundant, medium, rare, absent. I have preferred not to complicate matters by introducing these data measured on a four-step scale among those described on a two-end scale. It would

[8] It is of course possible that the Thomas sites are really similar to the Webb sites in pottery, to Harrington and Nacoochee in the remainder of the culture; but it would be hazardous to assume this without intensive reëxamination of all the material recovered.

have been possible to count abundant, medium, and rare occurrence as simply "present;" but little would have been gained by this, as thirty-three of the thirty-six traits would have come out as universally present at all five sites. I have therefore simply discarded the three remaining pottery traits.

The distribution of seventy-four non-ceramic traits is:

Gartner-Baum: 30, 6, 18, 20
G-Fox Farm: 16, 20, 20, 18
G-Feurt: 21, 15, 23, 15
G-Madisonville: 14, 22, 33, 5
B-FF: 27, 21, 9, 17
B-Fe: 29, 19, 15, 11
B-M: 25, 23, 22, 4
FF-Fe: 27, 9, 17, 21
FF-M: 25, 11, 22, 16
Fe-M: 28, 14, 19, 13

I use this time two new formulae: Q_2 and W. $Q_2 = (ad - bc)/(ad + bc)$. It is one of those devised by a mathematician, and is the quickest of these to compute. It is useless when one of the four values is 0, and gives exaggerated coefficients when one of the values approaches 0. $W = (a+d)/N$; in other words, agreements divided by the total number of traits. It differs from all the others in that its range is from 1.0 only to 0, instead of to −1.0. As a tie with the previous calculations, the Z coefficients are also added, although the two bear a constant re-

Q_2

	G	B	FF	Fe	M
G	X	.69	−.16	−.05	−.82
B	.69	X	.42	.06	−.67
FF	−.16	.42	X	.58	.25
Fe	−.05	.06	.58	X	.16
M	−.82	−.67	.25	.16	X

W

	G	B	FF	Fe	M
G	X	.68	.46	.49	.26
B	.68	X	.59	.54	.39
FF	.46	.59	X	.65	.55
Fe	.49	.54	.65	X	.55
M	.26	.39	.55	.55	X

Z

	G	B	FF	Fe	M
G	X	.35	−.08	−.03	−.49
B	.35	X	.19	.09	−.22
FF	−.08	.19	X	.30	.11
Fe	−.03	.09	.30	X	.11
M	−.49	−.22	.11	.11	X
Differential traits present	36	48	36	42	47

lation, the W values being spread only half as far from 1.0 as the Z values, so that the rank order of coefficients is identical by the two formulae.

The tables are so simple that it is not necessary to convert them into graphs; but to guide the eye I have introduced lines which box together the higher coefficients.

While the absolute coefficient values differ from table to table according to the formula used, it appears that the relative size or ranking of the coefficients, which is what is of significance, is the same by formula Q_2 and formulas W and Z.

Now it is at once evident that the Gartner and Baum sites form a related pair, and the Fox Farm and Feurt another. As between these two pairs, similarity of Baum and Fox Farm is closest. Madisonville is the most apart of the five sites. It has no high coefficients and the two lowest of all. Such relationship as it has is with the Fox Farm-Feurt pair. The total set of relationships thus is linear, not crossing or ramifying. It can be adequately represented by this simple diagram, in which closeness of relationship is expressed by spatial nearness of the site symbols.

G B FF Fe M

Griffin interprets the situation similarly on the whole, but with differences in detail. He unites Gartner and Baum into one focus or subclass, Fox Farm and Madisonville into another. Feurt, he finds in discussing pottery (p. 3), "seems to be intermediate between these two groups and to constitute, at least temporarily, a division by itself." I unite Feurt definitely with Fox Farm and set Madisonville most apart.

It remains to inquire into the reasons for this subsidiary difference in classification. One appears to be that Griffin bases his conclusions on

a series of thirty-five diagrams, most of them dealing with classes of traits such as Stone Implements or Burial Content. Even ignoring most of these, and confining ourselves to his diagrams on Total Traits, we have five graphic representations to be compared mentally. Another reason is that Griffin has included and I have excluded pottery. A third is that the older investigators, as in Tennessee, apparently slighted pottery as compared with modern practice, and that Griffin, like Webb, perhaps tried to correct for this inequality in the data.

GENERALITIES

In both cases we have come to the same result: General agreement, but specific minor differences, according as the same material is classified by a method of mixed statistics and inspection and a straight statistical procedure. Which yields the more reliable result? I do not wish to answer dogmatically. While my method seems simple, consistent and rigorous, I do not know at all either the Tennessee or the Fort Ancient material at first hand, and this is a factor not to be ignored. My collaborator, Driver, takes the view that proper statistical analysis is a self-sufficient technique and that if its results have to be validated by checking against results obtained by inspection or "intuition," it might as well not be applied. I am not ready to go quite so far. For one thing, while I understand what a formula like W or Z means, I do not, like most anthropologists, understand how R_{hk} is derived in mathematical theory, and how justly applicable it is, or when it is properly applicable, to a body of concrete data. For this reason I want to see how it works: what kind of a result it gives in specific cases, as compared with results by the intelligible W or Z, or results by the old-fashioned inspectional method which we all use. And I am submitting this essay so that archaeologists at large may also judge between the methods, as to which seems the more valid when there are differences in result, and, above all, why.

I do think I have shown that the coefficients can be sensitive, as when the Webb-collected pottery from Thomas sites comes out more similar to Webb sites than does the non-pottery Thomas material. However, there is such a thing as over-sensitiveness when we are looking for general results. And while we have found indication of a factor of collectors' personal equation, we have thereby also thrown some prima facie slur on all comparative interpretation of material assembled by more than one collector. That this doubt applies also to inspectional interpretations does not increase the reliability of statistical results.

What we have gained is cognizance of a potential disturbing factor against which we must be on guard.

Somewhat similar is the matter of the quantity of material necessary to ensure reasonable certainty of conclusions. Anyone would assume that in a comparison involving a total of a hundred traits, with the majority of sites averaging around fifty, a site from which only ten traits were recorded—whether because it was small, or partially excavated, or imperfectly reported—could presumably not be classified other than tentatively. But would it become validly usable when its inventory reached twenty, or thirty, or forty traits? It would be difficult to give an answer on the basis of inspection. In the case of Norris Basin we did find a seeming answer. Again, the statistical approach has proved to be an analytic tool. This is in general its primary value.

Sites are not the only archaeological phenomena which can be classified statistically. It is equally feasible to correlate elements. The data are then simply counted the other way: for element 1, sites I and II may show $++$ and therefore tally one in the *a* cell; I and III $+-$ and therefore *b;* I and IV another *a;* II and III, *b;* II and IV, *a;* III and IV, *c;* etc. The same count is made for element 2, then element 3, and so on. The result is a series of coefficients which show the degree to which the elements tend to adhere among themselves, to use Tylor's happy old phrase; in more modern language, how they segregate out into culture-complexes or culture-strata.

I have not computed the trait-complexes for either the Webb or the Griffin data because the number of cases—that is, sites—is so small (only ten and five respectively) that the coefficients would not be very significant. Besides, the complexes or strata are easily enough determined by inspection of the authors' tables and diagrams. Had the number of sites treated in either work approximated fifty, inspection findings would have been more difficult to make, and inter-trait correlations would probably have justified themselves in spite of the labor, especially as with many more sites the list of traits would almost certainly also have grown.

In such a larger situation, tabulated coefficients may be of more service. The culture complexes or strata at the fifty sites would automatically shake down, and with the best trial and error arrangement would clearly show their segregations and blends. This is difficult to do from direct inspection of many varying presences and absences distributed in many columns. The tendency is to think in terms of traits already known to be significant as culture markers. For instance, there

has been much discussion lately of the Hopewellian. One may therefore have Hopewellian criteria in mind, and proceed to classify sites into a minority that are Hopewellian and a majority non-Hopewellian. But the latter might really be an aggregate of several cultures, say three phases or aspects of Mississippian, plus transitions between them. These aspects would crystallize out in the coefficient table, and the transitions would also be indicated as such. An exceptionally acute inspection, it is true, might well reveal these several aspects and transitions, but rather as a "hunch," which one would want to demonstrate, in order to convince others, by some form of objective evidence. The coefficient table, to be sure, is not the only such objective demonstration; but it is probably the most comprehensive and compact.

A third procedure is to intercorrelate site classes with trait complexes after both have been determined. This shows how far any given site belongs wholly to one culture, or is hybrid, or belongs primarily to one but with influence from another; and conversely, the relative strength of say the Hopewell complex in all the sites compared.

By this time, however, one has done a good deal of computing, and spent even more time counting and recounting; and many situations do not warrant the labor. There is also a substitute device available. This has been employed before, somewhat occasionally and haphazardly, it is true, but my associate, Driver, has called my attention to it as a rapid and expressive equivalent for the site-trait correlation. It carries the further recommendation, to many, of avoiding all coefficients. In principle this device is merely a grouping of related sites in adjacent columns, irrespective of their geography or order of exploration, plus a grouping of correlated or adhering traits on adjacent lines, irrespective of whether they are of stone, bone, pottery, or part of structures or burials. This arrangement clusters out classes of trait-groups characteristic of site-groups, along a diagonal of the table; only this time the clusters consist of plus symbols, and elsewhere of minus symbols, for the traits themselves, in place of numerical coefficients. I illustrate by a rearrangement of the "structural traits" part of Webb's table, limiting myself to this to save space.

It appears that the small-log sites possess nine structural traits peculiar to themselves as against two peculiar to large-log sites; that seven traits are shared by small-log and large-log; further, that all nine of the site-17 traits occur in small-log sites, only five of them also in large-log ones. On the contrary, in burial traits, not rearranged here, site 17 goes with large-log. In a complete table, this vacillation of 17

STRUCTURAL TRAITS, FROM WEBB, REARRANGED TO SEGREGATE

	5	2	9	4	8	6	17	11	10	19
Cardinal orientation	x		x	x						
Corners closed by stakes	x	x	x	x	x	x				
Horizontal log molds outside trench	x	x	x		x					
Burned town house, primary floor	x	x	x			x				
Cane impressions, town house floor			x		x	x				
Vertical cleavage plane over post molds		x	x							
Horizontal log molds inside trench		x			x					
Woven mats on roof		x				x				
Bark slabs on roof		x	x							
Small log dwellings	x	x	x	x			x			
Small log town house	x	x	x		x	x	x			
Wall posts in trenches	x	x	x	x	x		x			
Door in corner	x		x	x	x		x			
Cane and grass as thatch	x	x	x	x	x	x	x		x	
Earth-covered town houses	x	x	x		x	x		x	x	
Dwelling-house patterns under mound	x		x	x			x		x	
Successive superposition of town houses	x	x	x		x		x		x	x
Dwelling patterns, not earth-covered	x	x					x	x	x	
Corners not closed by stakes	x						x	x	x	x
Dwellings of large logs	x							x	x	
Town house of large logs									x	x
Horiz. large log molds, town house floor									x	x

would be brought out, just through burial traits and others being set *in their affiliation place* among structural traits.

In any event, I think it is evident how much culture segregation and affiliation can be brought out by this device of tabular arrangement, without any coefficients; though if the number of sites is considerable, their prior objective grouping by inter-site coefficients will probably remain desirable.

Finally, the question naturally emerges, to what extent and over what range the coefficient method promises to be applicable. Is there any prospect, for instance, that it could ultimately be employed to classify all the prehistoric cultures of the eastern United States both geographically and into their patterns, phases, and aspects? I believe it is too early to say yes or no. If the task were undertaken mechanically and wholesale, the labor would be prohibitive. A thousand sites, for instance, yield nearly half a million interrelations. Also, between most of them, the number of *d*'s—common absences—would be so great as to make the four-cell values heavily skew. On the other hand, done step by step, the task would be much reduced. For instance, a group of Fort Ancient sites determined by their coefficients as a true group ("aspect") on comparison with other Ohio sites, could then be merged or pooled

and their traits reduced to a unitary Fort Ancient list. And so on.

A year ago at the University of Chicago, stimulated by the local archaeological activity and the Milwaukee meeting, I went so far as to begin compiling a trait list for the eastern United States. This was based on specific archaeological reports from New York, Ohio, Illinois, Iowa, and Nebraska, and quickly ran to several hundred items, many of which McKern was good enough to revise. This list was left at Chicago and no doubt is available to anyone interested. On further consideration I am less sure that this is the way to commence. It may be better to compile and compute local trait lists, expanding these until their range covers an area about as large as a state, then tie together such areas. Trial alone can tell. I am certain that in any larger comparison dealing with materials collected and described by a number of archaeologists, the first requisite will be a clearly defined typology. "Plummet," "discoidal," "cord-marked" may each be a true and constant element or they may prove to have been used in different senses and to break down, each into several traits. Determination between these alternatives can only be made by Eastern archaeologists genuinely familiar with more than local material. The first requisite seems to be a sound comparative typology. Once we have this, the rest will follow, whether with the help of statistical devices or otherwise. The main help that statistics promises is in arriving at an objective basis, instead of an essentially agreed basis, for the grouping of sites into foci, these into aspects, and so on down to bases, or whatever other categories may be demanded by the phenomena.

University of California
Berkeley, California
September, 1939

ADDENDUM

A year's further experience since this article was written reenforces the cautions expressed on pages 31, 35, and 41. The difficulty is that under the four-cell method a trait lacking at a site is counted as lacking from the culture, whereas actually it may have been present but happened not to be left at the site, or not to be found. We experience the same difficulty with ethnological trait lists compiled from the literature: that an author does not mention a trait does not necessarily mean that it was absent. (On the contrary, in a planned presence-absence field inquiry, a mere third or fourth of a trait list, being a random sample as far as it goes, will compare reliably with a full list.) Archaeological sites with markedly meager inventories must therefore be used very cautiously: some of their apparent c's and d's may have been actual a's and b's. The error is not excludable, but may sometimes be reduced by using Webb's formula $a/(a+b+c)$. In fact his 45 percentages yield a diagram comparable with mine. It differs somewhat, and is not quite so definite; but its classification may be as true, or more so. The moral is that reserve is necessary where trait inventories vary by more than about a third in size.

PIPESTONE AND RED SHALE ARTIFACTS

DAVID H. HOWELL

DURING the summer and fall of 1938 the writer made several trips into Arizona and while there visited various museums in the central and northern part of the state. In each of these he encountered numerous artifacts made of a red shale material which varies in color from a light pink to a dull red. This is often referred to locally as pipestone. On more than one occasion the writer was asked if these rock samples were catlinite and was astonished to find that he could not answer this query, nor, indeed could he define or properly describe catlinite. It was quite apparent, moreover, that much confusion prevailed concerning many of the red-stone artifacts incorporated in the museum collections and that some few people were drawing far-reaching conclusions[1] as to the extent of commerce and trade indulged in by our North American predecessors. Regrettable as this tendency is, it is not entirely unexpected since research with pipestone has been neglected. In addition, great stress has been laid upon the Minnesota occurrence of catlinite and few writers have mentioned that this material occurs elsewhere. Consequently an examination was commenced which it was hoped would aid in clarifying this matter.

The object of this paper is threefold: (1) to report certain mineralogical and chemical aspects of catlinite, (2) to describe a specific technique for differentiating pipestone and similar materials from various sources, and (3) to suggest the archaeological importance of further mineralogical investigations with other source material.

For an historical résume of pipestone and its use by the Indians of the upper Mississippi and Missouri valleys, the reader is referred to the monumental work of N. H. Winchell[2] wherein he lists the principal writings of the early adventurers and explorers of that region. Almost without exception each of these men reports having smoked a "calumet" when counselling with the Indians. Though these references are too numerous to be included here, a few are quite pertinent.[3] Carver in

[1] Mearns, Edgar A., *Popular Science Monthly*, Vol. 37, No. 6, pp. 745–763, 1830: also verbal comments while the writer was in the field.

[2] Winchell, N. H., *The Geology of Minnesota*, Vol. I of The Final Report of The Geologist and Natural History Survey of Minnesota, 1872–1882, pp. 1–110.

[3] *Op. cit.*, p. 24.

Carver, J., *The New Universal Traveler* (London 1779), p. 631.

Shea, J. G., *Discovery and Exploration of the Mississippi Valley* (New York, 1852), p. 35.

reporting on his North American travel says, "Near that branch which is termed the Marble River, 'possibly he refers to Pipestone Creek' is a mountain from which the Inidans get a sort of red stone, out of which they hew the bowls of their pipes." Winchell has a note to the effect that doubtless Carver refers to the Pipestone County outcrop of catlinite. Probably due to the difficulties of travel and furthered by the fact that this occurrence of pipestone was not on the main route of adventurers, it remained for over a hundred years unvisited by whitemen.

The visit of George Catlin to this pipestone quarry and his subsequent account are well known and are usually referred to in writings on this subject.[4] Since that time other occurrences of pipestone have been reported and some of this material has been analyzed.[5] From then until now these analyses have remained as the answer to the question what is catlinite, despite the suggestions of both Catlin and Winchell that it would be highly desirable to make further investigations and careful analyses of this peculiar rock.

Recently Ernest L. Berg of the University of Minnesota published a paper on the mineralogy and relations of the catlinite beds at Pipestone[6] and says, "The present study indicates that the catlinite, or red pipestone, is composed predominantly of sericite and that the coloring replacing mineral is pyrophyllite." This gives us, for the first time, something definite to refer to and likewise a point of departure for future work.

DESCRIPTION OF MATERIALS

The materials for this research were procured from various individuals and museums, particularly from Arizona and California. Numerous artifacts were examined and where possible, typical samples were obtained for laboratory analyses. The specimens of catlinite and red shale which were used for standards and are enumerated in Tables I and II, are authentic source types.

The sample marked *Minnesota* was donated by the Pomona College Geology Museum and was said to have come from Pipestone, Minnesota. The South Dakota one, from the same museum, bore a paper saying, "So. Dakota Territory." Specimens numbered M-3 and M-6

[4] Catlin, George, *American Journal of Science* (1), Vol. 38, p. 138, 1840.

[5] Winchell, N. H., *Op. cit.*, p. 542.
Woodman, E. E., *Wisconsin Academy of Science Transactions*, Vol. 5, pp. 251–254, 1882.

[6] Berg, Ernest L., *American Mineralogist*, Vol. 23, pp. 258–268, 1938.

were received from the University of Minnesota and were donated respectively by the departments of Geology and Anthropology. They were said to be similar to the material examined by Berg.[7] Sample number 371 was said to have come from Barron County, Wisconsin. It was furnished by the Milwaukee Public Museum and this occurrence of catlinite is described in its publications. This particular specimen is said to have been taken from Site No. 5.[8]

The Del Rio, Arizona,[9] material was procured by the writer and represents three separate outcrops.[10] Samples numbered 300 and 303 are from the same site designated as Pit 1 and present a different appearance from samples numbered 305 and 374. These two occur in a badly fractured zone and the location is called Pit 2. At this point the shale is decidedly slaty, while at the former location it appears more compact and homogeneous in texture, perhaps because it was outside the belt of shearing. Samples numbered 372 and 375 came from a third outcrop which, like the second shows slickensiding. The associated quartzite and conglomerate country-rock at Pit 3 is also slickensided. This occurrence is about a quarter of a mile up the hillside from the other slaty shales.

A total of twelve specimens of typical northern catlinite were employed to determine the characteristics of this substance. Fourteen individual Arizona pieces supplied the data for the southern red shale.

SPECTROGRAPHIC TECHNIQUE

The chemical composition of the various samples was determined spectrographically. The technique employed has been previously

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[7] Note on specimen bags received from Department of Geology, University of Minnesota.

Personal Communication with the Anthropology Department, University of Minnesota; also correspondence with Ernest L. Berg, 1938.

[8] Barrett, S. A., *Milwaukee Public Museum Yearbook*, Vol. 4, pp. 16–18, 1924.

West, G. A., *Milwaukee Public Museum, Bulletin 17*, Part I, p. 329.

Personal communication of the Museum, January 1939.

[9] A station on the Prescott, Ashfork and Phoenix branch line of the Santa Fe twenty miles north of Prescott, Arizona.

[10] Location: Yavapai County, Township 17, R. 1, W. Sections 38 & 34.

Pit #1—No claim papers found.

Pit #2—Filed "Lode Claim"—White Metal Mine. April 1927 by L. J. Rinehardt and Alex Ratcliff. Relocated, "Placer Claim"—Clay Bank No. 1, January 1936, by A. Noxan and Grace M. Sparkes.

Pit #3—Filed "Placer Claim" date obscured. Clay Bank Extension—by A. Noxan and Grace M. Sparkes.

described,[11] though slight variations were found to be advisable. Specially prepared graphite electrodes were used which had been purified[12] to reduce their content of sodium, lithium, calcium, copper and silicon as well as other minor impurities.

It was found desirable to use two methods of spectra excitation: (1) that produced by a full-load sample, consisting of heaping all the powdered material possible upon the electrode, about 50 milligrams, and (2) that produced by an accurately weighed 20 milligram sample. The larger samples were used in recording total composition and traces of the minor constituents. The standard spectrograms, to which the spectra of the artifacts were compared, were made with weighed amounts of material.

For spectrographic analysis, samples of the crude materials and certain damaged artifacts were obtained by grinding fragments from these in an agate mortar. Samples from unbroken artifacts were produced by scraping the museum pieces with the blade of a knife. Slight iron contamination was not deemed significant, as all the type material contained iron and this element was not diagnostic of any particular source.

Standard spectra were recorded of solutions containing known amounts of those elements which were found to be diagnostic in differentiating between northern and southern material. These plates were used for relative quantitative interpretations of the standard plates of each source type.

Throughout the entire spectrographic examination close check was kept on all the variable conditions and these were maintained as constant as possible in order that the spectra obtained would be comparable.

DISCUSSION OF RESULTS

The chemical compositions of the Minnesota, South Dakota and Wisconsin catlinite, as well as the Del Rio red shale, were determined spectrographically to be predominantly aluminum, silicon, and iron, with minor elements as set forth in Table I. This table shows the complete analyses of those samples which were used in the comparative interpretations and will be referred to as the *Standard Samples*.

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[11] Kennard, T. G., *American Mineralogist*, Vol. 20, pp. 392–399, 1935.
Kennard, T. G. and Howell, D. H., *American Mineralogist*, Vol. 21, pp. 721–726, 1936.

[12] Staud, A. H., and Ruehle, A. E., *Industrial Engineering Chemistry, Analytical Edition* 10, p. 59, 1938.

TABLE I. CHEMICAL COMPOSITION

Specimen	*Large*	*Medium*	*Small*	*Very Small*	*Trace*	*Minute Trace*
M-3	Al Si	—	Fe	K Ca Na V	Li Ti Cr Sr Mg Mn	Ba Ga Cu V B
M-6	Al Si	—	Fe	K Ca Na	Li Ti Cr Sr Mg Mn	Ba Ga Cu V B
Minnesota. (Pomona College)	Al Si	—	Fe	K Ca Na	Li Ti Cr Sr Mg Mn	Ba Ga Cu V B
So. Dakota. (Pomona College)	Al Si	—	Fe	K Ca Na	Li Ti Cr Sr Mg	Ba Ga Cu Mn V B Ag
#371. (Wisconsin)	Al Si	—	Fe	K Ca Na	Li Ti Cr Mg Mn Sr	Ba Ga Cu V B
#300.	Al Si	—	Fe	Ca	Na Li Ti Cu Mg Mn	Cr Sr Ba Ga V B
#301.	Al Si	—	Fe	Ca	K Na Li Ti Cu Mg Mn	Cr Sr Ba Ga V B
#303.	Al Si	—	Fe	Ca	K Na Li Ti Cu Mg Mn	Cr Sr B Ga V B

TABLE I. CHEMICAL COMPOSITION (*Continued*)

Specimen	*Large*	*Medium*	*Small*	*Very Small*	*Trace*	*Minute Trace*
#305.	Al Si	—	Fe	—	Ca Na Li Ti Cu Mg Mn	Cr Sr Ba Ga V B
#372.	Al Si	—	Fe	—	Na Ca Li Ti Mg Cu	Cr Sr Ba(?) Ga(?) V
#374.	Al Si	—	Fe	—	Na Ca Li Ti Mg Cu	Sr Ba(?) Ga(?) V Cr
#375.	Al Si	—	Fe	—	Na Ca Li Ti Mg Cu	Cr Sr Ba(?) Ga(?) V

Small = x. %
Very small = 0.x %
Trace 0.0x–0.00x %
Minute trace = 0.000x % and less.

The quantitative designations of this table are purely relative and each represents a considerable range in amounts present. Elements

TABLE II. READINGS OF MASTER PLATES

Specimen	*Elements Compared*							
Name or Number	Na	Li	K	Ca	Ba	Sr	Cu	Ag
Minnesota (Pomona C.)	0.02	0.01	0.4	0.004	0.001	0.01	0.001	—
So. Dakota (Pomona C.)	0.02	0.02	0.4	0.002	0.0004	0.004	0.004	0.0001
#M-6 Minn. U. Anthropology.	0.02	0.05	2.15	0.004	0.001	0.01	0.001	—
#M-3 U. Minn. Geology.	0.04	0.1	2.15	0.004	0.001	0.004	0.004	—
#371. Wisconsin	0.02	0.05	0.4	0.004	0.001	0.004	0.001	—
#300 Del Rio, Ariz.	0.03	0.001	0.05	0.001	0.0004	0.0004	0.002	—
#303	0.01	0.0004		0.001	0.0004	0.001	0.02	—
#305	0.004	0.0004		0.0002	0.00001(?)	0.0004	0.01	—
#372	0.004	0.001		0.0001	0.00005(?)	0.0004	0.004	—
#374	0.004	0.001	Less than 0.046	0.0002	0.00005(?)	0.0004	0.01	—
#375	0.004	0.001		0.0001	0.00005(?)	0.0004	0.004	—

grouped under the headings large, medium and small are those indicating the predominant chemical composition. The remaining elements are of minor compositional importance chemically, but their value must not be underestimated in showing characteristic differences between material from various geographical and geological sources. Slight variations in the intensities of certain spectrum lines, readily interpretable to the spectroscopist, cannot be easily represented graphically in a table of this type. Table II is included to aid the reader in visualizing these changes in the amounts of certain minor constituents.

During the reading of the preliminary spectrograms it was noticed that some eight elements might possibly prove to be characteristic of northern and southern material. Consequently a set of standard spectra were made from solutions containing known amounts of each of these elements.[13] Comparisons were then made between the spectra of the *Standard Samples* and those of the various solutions. In this manner it was found possible to assign quite accurate relative values to the amounts of these specific elements present in the analyzed samples.

To be sure, the spectra of solutions cannot be compared directly to those of solids, in this case, but if the spectra of the solutions are employed merely as arbitrary bases for estimating quantities in any particular case, the relative amounts of these elements present in an unknown can be bracketed within quite definite limits. For example, if the persistent spectrum lines of sodium in one sample correspond to those in the standard solution spectrum of sodium with a concentration of 0.01, and to the spectrum of sodium with a concentration of 0.02 in another, the latter could be said to contain approximately twice as much sodium as the former. Table II lists the amounts of the characteristic elements in question evaluated as described.

Consideration of this table will show that there are striking differences between the specimens from the northern and southern sources. Perhaps the most outstanding dissimilarity is to be found in the alkali elements. Potassium, a constant constituent of the northern material, is either extremely minute or entirely missing in the southern samples examined.[14] Sodium and lithium show a similar decrease between speci-

[13] The solutions were made as follows: Weighed amounts of each of the elements calculated either as oxides or as pure metals were put into solution. Successive dilutions were then made by adding water to make each concentration vary as the cube root of ten, i.e., 0.1, 0.046, 0.022, 0.001.

[14] The persistent lines of potassium in samples 303 to 375 were weaker than those of this element in the solution with a concentration of 0.046 mg. K_2O per 0.1 ml. This being the weakest readable potassium spectrum, the presence of that element is questionable

mens from these two sources. Calcium, strontium and barium vary in the same manner, being much less in the southern shales. Copper, however, increases strongly in the Arizona types. The presence of silver in the South Dakota sample is of especial interest. This element is definitely absent in the pipestone and shales which have been examined from other than this particular source.

Portions of the spectra of specimens M-3 and 306 are illustrated in Plate IX in order to show the differences in the intensities of the sodium, lithium, potassium and calcium lines. The spectra represented are in a part of the "visible region."

Having determined the significant differences between the northern and southern type materials, it was deemed advisable to test the theoretical conjecture, that a correlation was possible, before making any assignments of artifacts to definite sources. Consequently, spectra of material other than that used for making the *Standards* were compared to determine whether or not they matched their prototypes. Employing fragments of red shale from Del Rio, Arizona, it was astonishing to note that certain pieces resembled each other so closely that it was possible to hazard a surmise as to which specific outcrop they had come from.[15] Samples said to have come from the Pipestone quarry in Minnesota were likewise compared with those used as *Standards*. The similarity of spectra was astounding. This ability to differentiate between samples, some of which were closely related geologically, added materially to the possibility of identifying artifacts and the comparison of museum specimens was commenced at once. The results of this work are set forth in Table III which lists the artifacts examined and assigns them to provisional source types.

The chemical composition of both the northern and southern materials indicates that they are predominantly hydrous aluminum silicates with various amounts of iron as an impurity.[16] This agrees with the results of previous workers (see footnotes 5 and 6, above) who have called pipestone an indurated clay or clay-like substance. A petrographic study was instituted to determine the type of clay-minerals in each of the two varieties.

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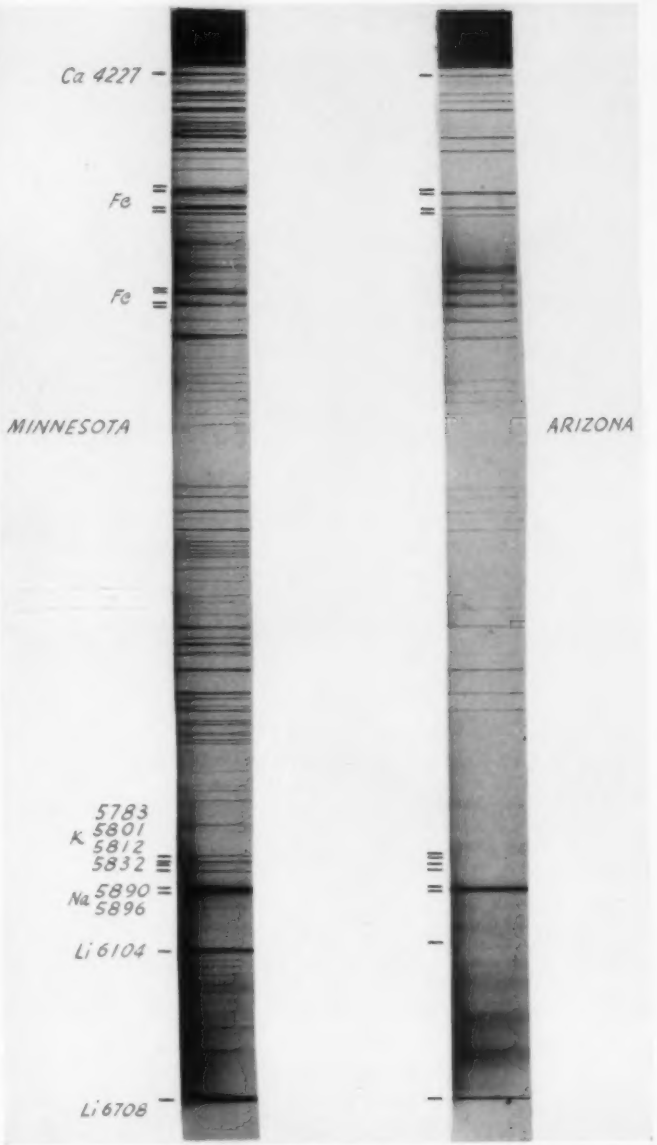
in the specified samples. Similarly barium in samples 306 to 375 followed by the (?) in Table II, is questionable. The persistent lines of barium were weaker than those shown by the weakest solution, which had a concentration of 0.0004 mg. BaO per 0.1 ml.

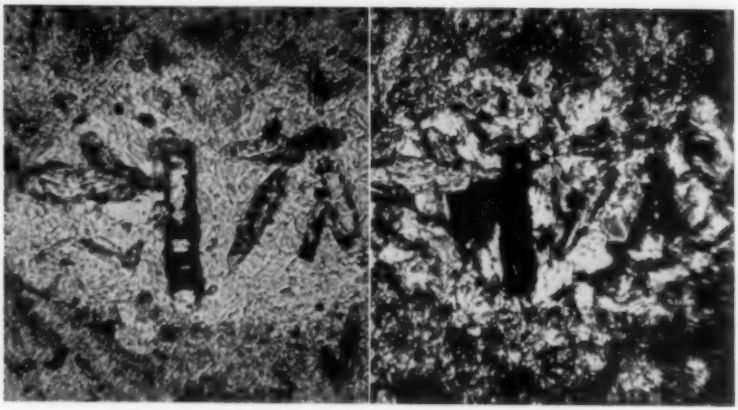
[15] Two of these outcrops are not more than one hundred yards apart.

[16] The presence of water was determined by the Penfield method though no quantitative estimation was made.



Spectrographs of northern pipestone and southern red shale.

MINNESOTA
Diaspore in Pyrophyllite

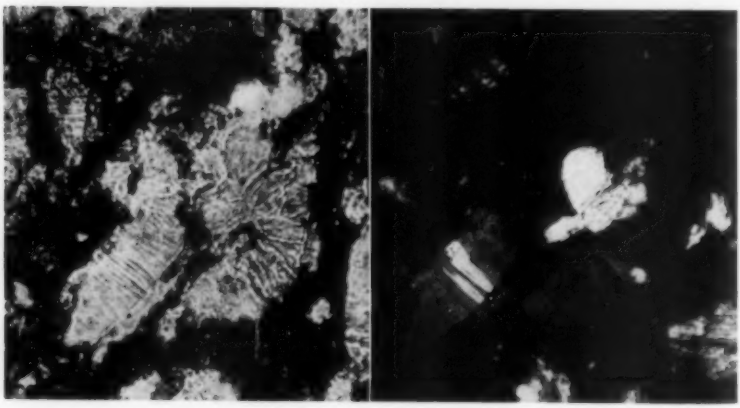


Plain Light Crossed Nicols

ARIZONA

Kaolinite Vermiculites
Sericite-like Inclusions

Kaolinite Vermiculites
Sericite-like Inclusions



Plain Light Crossed Nicols

Magnification 200 ×

PETROGRAPHICAL DATA

The petrographic data were obtained in the usual manner. Observations were made, employing both crushed fragments and thin sections of each of the various rock types.

A thin section of the Minnesota specimen (see Tables I and II, Pomona College Collection) showed that this material was an exceedingly fine-grained aggregate of several different minerals. It consisted of a reddish groundmass which was continuously interrupted by a multitude of lighter colored pinkish areas. These light-colored zones were more or less oriented or elongated, suggesting bedding of the deposited sedimentary material or rearrangements due to stress or both. The color of the groundmass varied in different portions of the section and showed a banded structure similar to that of the inclusions.

The lighter zones and spots were found to be predominantly pyrophyllite. The indices of refraction were found to be $N_\gamma = 1.598 \pm 0.001$ and $N_\alpha = 1.554 \pm 0.002$. The birefringence was moderate to strong. Certain rather well-formed crystals identified by their high index of refraction and strong birefringence proved to be diaspore. The latter was found to be a common inclusion throughout the pyrophyllite areas. Hematite, with possibly some limonite, was apparently responsible for the general reddish color. The limonite may be contributory to certain of the yellowish inclusions associated with the diaspore and pyrophyllite. Sericite, which was identified by Berg (see note 6, above) was not identified as such, petrographically, in this sample of Minnesota material, though a micaceous mineral was noticeably present. No positive identification of sericite was made in any of the materials from northern sources.

A section made from the South Dakota sample, though considerably lighter colored than the Minnesota specimen, contained essentially the same minerals. Its microscopic appearance, however, was somewhat different. While the former was composed predominantly of a reddish groundmass with lighter colored areas, this section showed approximately equal light and dark zones. Texturally they were similar and as in the previous case the principal minerals were pyrophyllite, diaspore and hematite, with one additional mineral, kaolinite. This appeared to be a replacement mineral along seams or fractures. It was readily identifiable by its indices of refraction, low birefringence and vermicular structure.[17] A micaceous mineral was also present as in the Minnesota case.

[17] Ross, C. S., and Kerr, P. F., *United States Geological Survey, Professional Paper* #165.

The Wisconsin specimen appeared to be very similar in texture and mineral composition to the Minnesota sample.

Thin sections of two samples of Del Rio red shale obtained from Pit 1, may be described as fine-grained aggregates of at least five different minerals. The color of the material varies from a light pink to a dark brick red. Like the Minnesota pipestone, it contains throughout its mass, spots of a light-colored substance. Bands of this yellowish to pinkish material were usually found along the contacts of the shale and its inclosing quartzite. The borders between the red and pinkish portions were quite regular and distinct. Bedding of the original clay materials has been preserved in the indurated products. Distinct alignment of mineral grains was not apparent in sections from this outcrop. The five essential minerals identified in the specimens numbered 300 and 303 are as follows:

A. Kaolinite. Indices of refraction were,

$N_r = 1.565 \pm 0.001$ and 1.570 ± 0.001 $\quad$ $N_a = 1.574 \pm 0.002$ and

The birefringence was low. Typical kaolinite vermiculites and rosettes were abundant.[18]

B. Several crystals of an isotropic substance with an index of refraction of 1.584 ± 0.002, were observed in each microscopic field. These may have been Schroetterite.[19]

C. Pyrophyllite, determined by indices of refraction and micaceous appearance.

D. Hematite, identified by its appearance in transmitted and reflected light.

E. A sericite-like mineral, which showed high interference colors and occurred as inclusions in the kaolinite, but was not positively identified. The optical data obtained gave values for the birefringence which were too low for the mica minerals or illite[20] being approximately 0.02. More information must be obtained before this mineral can be accurately classified and it will be called, for the present, a sericite-like mineral.

Those sections made from the shales from Pit 2 and Pit 3 contained

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[18] *Op. cit.*

[19] Larsen, E. S., and Breman, H., *United States Geological Survey Bulletin* 848, p. 52, 1934.

[20] Grim, R. E., Bray, R. H., and Bradley, W. F., *American Mineralogist*, Vol. 23, pp. 813–829, 1937.

the same five major mineral constituents as just enumerated, but their texture is distinctive. Crystals of kaolinite were much better developed and larger as well as more profuse in these latter specimens. Furthermore there seemed to be a decided tendency for the crystals to show alignment. This was lacking in the former materials and, in addition, the shale has a slaty appearance.

Photomicrographs, illustrated in Plate X, show the dissimilarity between northern and southern materials. From the foregoing it would appear that the northern pipestone was an altered shale composed predominantly of pyrophyllite, hematite and a sericite-like mineral as against a predominance of kaolinite for the Arizona shales. This agrees, in part, with the conclusions of previous workers.[21]

CONCLUSIONS

From the results of the spectrographic examination it would seem that the variances in sodium, lithium, potassium, the alkaline earth elements and copper are sufficient to separate the northern pipestone from the red shale of the Southwest. Silver seems to be a diagnostic element in differentiating South Dakota material from that of Minnesota and Wisconsin. A spectrographic analysis as outlined is, moreover, admirably suited to such investigations because of the extreme sensitivity of the method in the detection of very small amounts of these elements in limited samples. Twenty milligrams of scrapings are in most cases adequate for any determination.

Throughout this entire investigation a marked constancy was noted between the ratio of the amounts of the eight important elements present in samples from each locality. To be sure, there were quantitative differences in specimens from the same source, but the ratio of certain specific elements remained quite constant. The maintenance of this ratio formed the basis for the assignment of artifacts to particular sources. Lithium and sodium ratios were most outstanding and helpful in this connection. The spectra of some of the artifacts showed a reduction in the total amounts of the alkalies present in these samples, but the sodium-lithium ratios were comparable to the *Standards*. The reduction may be accounted for by weathering and these particular artifacts may have been made from "float" commonly found in the stream-beds adjacent to or slightly removed from the original source. Aluminum silicon ratios were not deemed significant enough in this preliminary examination to warrant their investigation, but it is

[21] Gladwin, Haury, Sayles and Gladwin, Medallion XXV, p. 126 and p. 130, 1937.

thought that they may play an important role in separating materials from closely allied sources. Spectra which exhibited marked divergence in their alkali ratios from those of the *Standards* were readily identified and the specimens involved were left unclassified (see Table III).

Careful sampling of valuable museum pieces may usually be carried out with a minimum of disfigurement. Pipes, for example, are best sampled by scraping the material from the stem orifice or bowl, provided the latter does not contain tobacco or leaf ash. In this case it is better to procure a sample from the butt end of the shank where any damaged surface may be obscured when the stem is inserted. If it should be necessary to remove material from the exposed outside area of a valuable piece, a little sanding and subsequent polishing with a cloth, dry or slightly moistened with linseed oil, will usually remedy a minor defacement. Specimens which have been "killed," or otherwise chipped, offer no particular sampling difficulties.

The mineral composition of northern and southern materials may be determined petrographically. There are, however, two major difficulties. The first is the size of the required sample if a thin section study is found to be desirable and, in general, sections are more valuable than crushed fragments. It has been shown, in the paragraphs on petrographical data, that texture was important in determining the exact source. Thus, though a determination of the mineral constitutents could be carried out in oil with fragments, it would by no means be complete. Secondly, the presence of silver could not be detected petrographically and this seems important in differentiating between Minnesota or Wisconsin and the South Dakota material.

Petrography was important in this investigation, however, in showing the nature of the aluminum silicates in specimens from different localities. It was of especial importance in the determination of the constancy of mineralization and textures.

Summing up the data set forth in this section it might be possible to offer some descriptions and to define pipestone a little more clearly than heretofore. Winchell evaded any direct description by saying, "It seems to be only when this formation [Catlinite of Pipestone County] is greatly indurated that the inclosed shale beds are hardened to the condition of pipestone."[22] Dana[23] classifies it as a clay-like mineral or substance. Berg[24] is slightly ambiguous in his statement ". . . that the catlinite or

[22] Winchell, *op. cit.*

[23] Dana, E. S., *A Textbook of Mineralogy*, Revised by Ford, W. E., Fourth Ed. p. 684, New York, 1932.

[24] Berg, *op. cit.*

red pipestone, is composed predominantly of sericite and that the light colored replacing mineral is pyrophyllite." Does he intend to convey the thought that only the material which is *red* is Catlinite? What about the specks and lighter colored areas? If we accept the above definition literally we must then say that Indian pipes made from the Minnesota shale are made of catlinite and pyrophyllite. In a similar manner and for the same reason we should be forced to say that the South Dakota shale, being often very light in color, is pyrophyllite with some catlinite inclusions. This seems to the writer to be too fine a distinction and that it would be far wiser to include more than just the red material in a definition of catlinite or pipestone.

It has been suggested to the writer that the word catlinite be confined to that material which comes from Pipestone County, since this was the material analyzed by Jackson who offered the term catlinite in honor of George Catlin.[25] Such a restriction would result in leaving us wondering what to call a similar shale which appears in Rock County, which is adjacent to Pipestone County.

Geologists seem well agreed that the Pipestone County shale is contemporaneous with the Sioux quartzite, the country rock, and they have assigned to it a pre-Cambrian age.[26] Sioux quartzite occurrs over many square miles in various parts of Minnesota and South Dakota, and even as far east as Wisconsin.[27] The Barron County material examined in this investigation is found in a formation of pre-Cambrian quartzite, and likewise that of the Sioux Falls and Flandreau districts in South Dakota.[28]

Correlating all this data it would appear advisable to apply the term catlinite to all that material which possesses the same mineral constituents, general chemical composition and physical properties as the Pipestone quarry material, regardless of color. On this basis catlinite would be classed as a rock rather than a mineral or mineral variety. It would have a wide range of color and some variations in composition which should, of course, be limited. The exact limits would have to be determined from more comprehensive analyses of similar materials from many other sources than have heretofore been investigated. The writer is in favor of continuing the use of the word catlinite, but considers it advisable to widen its scope from that intimated by Berg and

[25] Jackson, C. T., *American Journal of Science* (1), Vol. 35, p. 388, 1839.

[26] Lexicon of Geological Names of The United States, *United States Geological Survey Bulletin* 896, Pt. 2, p. 2004.

[27] See footnotes 5 and 8.

[28] See footnote 5.

others. Contrarily, if the narrower meaning is found desirable, it will be necessary to introduce some other term for these other materials. Such a proceeding would add more confusion to the problem than now exists.

The Arizona material, also pre-Cambrian in age, does not possess the same mineral constituents as the northern varieties of shale and thus should not be classed as catlinite. Pending the publication of a paper by E. D. Wilson[29] on the geology of the Del Rio and other pre-Cambrian rocks of Arizona, it is suggested that the Arizona catlinite-like materials be called Red Shale. This would leave the matter open and in the event that a more suitable term be found a change can be readily made.

Through precedence the word pipestone is often used synonymously with catlinite. Perhaps this usage is so well established that any change would be unwise, but the word pipestone alone and unmodified does not convey any specific description of a material to the writer's mind. Schoolcraft, Moorehead and others[30] describe pipes made of steatite, serpentine and other sectile rock substances. These, in the broadest sense of the word, are pipestones just as truly as catlinite. It is suggested therefore, that this word be employed only when properly modified by some adjective which describes the variety of the rock or mineral used in making a pipe or other artifact: i.e., catlinite pipestone, steatite pipestone, red shale pipestone, and so forth. A more precise terminology seems highly desirable, since some confusion, now existing because of ambiguity, could be eliminated. Furthermore, field workers in geology and mineralogy would know exactly what type of material to look for when searching for new and unrecorded sources of pipestone.

In concluding this paper the writer would like to point out some desirable directions for further work. Study of the geological literature has shown that pre-Cambrian quartzites occur in many localities in western North America. In Arizona the formation in which the Del Rio shales are found is known as "Mazatzal quartzite." This rock is said to outcrop in the vicinity of the Verde River not far from Pine. It is reported in the Ft. Defiance area in northeastern Arizona, and minor occurrences are numerous throughout the central portion of the mountain region.[31] Consequently these areas may prove to be sources of red

[29] Wilson, E. D., University of Arizona. Personal Communication.

[30] Among others: Schoolcraft, H. R., *Archives of Aboriginal Knowledge*, Vol. I, pp. 76–79, 1860.
Moorehead, W. K., *The Stone Age in North America*, Vol. II, pp. 29–92, 1910.

[31] Wilson, E. D., *Pan American Geologist*, Vol. 38, pp. 299–312, 1922.

shale similar to that of Del Rio and warrant investigation. The fact that twelve artifacts found in the Southwest do not fit the Del Rio type material accurately, yet are southern rather than northern in general character, suggests at least two other sources for this red shale. (See Table III.)

TABLE III. COMPARISON OF ARTIFACTS AND STANDARD PLATES

Specimen	*Origin*	*Museum Number*	*Description of Artifact*	*Similar to Standard Sample*	*Type*
MNA—1.	Museum of Northern Ariz.	721/NA 2798.36	Bracelet	#305	Southern
MNA—2.	Museum of Northern Ariz.	148/580 NA 660	Ornament	#374	Southern
MNA—3.	Museum of Northern Ariz.	479/2380A	Ornament	#300	Southern
MNA—4.	Museum of Northern Ariz.	696/A219	Field specimen	#305	Southern
MNA—5.	Museum of Northern Ariz.	none	Broken object	Minnesota (Pomona Coll.)	Northern
MNA—6.	Museum of Northern Ariz.	none	Assorted shale samples. (Raw material.)	#374	Southern
Montezuma Castle			Pendant	#374	Southern
Specimen #301	Del Rio		Raw material	#300	Southern
Specimen #302	Del Rio		Raw material	#300	Southern
Specimen #304	Del Rio		Raw material	#305	Southern
Specimen #306	Minnesota (Mr. Hawley)		Raw material	Minnesota	Northern
Specimen #307	Minnesota (Mr. Hawley)		Raw material	Minnesota	Northern
Specimen #308	Southwest Museum	none	Pipe	South Dakota	Northern
Specimen #309	Tuzigoot Museum	none	Tubular pipe	South Dakota	Northern
Specimen #311	Claremont Colleges' Museum	130	Pawnee pipe	#372	Southern
Specimen #312	Claremont Colleges' Museum	131	Pipe	Minnesota	Northern
Specimen #313	Claremont Colleges' Museum	132	Pipe-stem	Minnesota	Northern
Specimen #314	Claremont Colleges' Museum	133	Pipe	Minnesota	Northern
Specimen #315	Claremont Colleges' Museum	134	Pipe	South Dakota	Northern
Specimen #316	Claremont Colleges' Museum	135	Pipe	South Dakota	Northern
Specimen #316a	Claremont Colleges' Museum	135	Stone pipe-stem	South Dakota	Northern
Specimen #317	Claremont Colleges' Museum	136	Pipe	Minnesota	Northern
Specimen #318	Claremont Colleges' Museum	137	Pipe	Minnesota	Northern
Specimen #318a	Claremont Colleges' Museum	138	Pipe-stem	Minnesota	Northern
Specimen #319	Claremont Colleges' Museum	139	Pipe	South Dakota	Northern
Specimen #320	Claremont Colleges, Museum	140	Pipe and Tomahawk	Minnesota	Northern
Specimen #320a	Claremont Colleges' Museum	140	Pipe-stem	Minnesota	Northern
Specimen #321	Claremont Colleges' Museum	141	Sioux pipe	South Dakota	Northern
Specimen #322	Claremont Colleges' Museum	142	Necklace	South Dakota	Northern
Specimen #337	Museum of Northern Ariz.	627 A271	Nose plug	Does not resemble any particularly.	Southern
Specimen #338	Museum of Northern Ariz.	302 1535	Nose plug	Does not resemble any particularly.	Southern
Specimen #339	Museum of Northern Ariz.	693 NA405R30.19	Nose plug	Does not resemble any particularly.	Southern
Specimen #340	Museum of Northern Ariz.	415 2040.5	Pendant	Does not resemble any particularly.	Southern
Specimen #341	Museum of Northern Ariz.	532 NA2100.1	Long bead	Does not resemble any particularly.	Southern

TABLE III. COMPARISON OF ARTIFACTS AND STANDARD PLATES (*Continued*)

Specimen	*Origin*	*Museum Number*	*Description of Artifact*	*Similar to Standard Sample*	*Type*
Specimen #342	Museum of Northern Ariz.	312 1617	Animal pendant	South Dakota	Northern
Specimen #343	Museum of Northern Ariz.	409 1902	Worked piece	Does not resemble any particularly.	Southern
Specimen #344	Museum of Northern Ariz.	437 2230	Unfinished bead	#374	Southern
Specimen #345	Museum of Northern Ariz.	584 NA 2098A.73		#303	Southern
Specimen #346	Museum of Northern Ariz.	932 NA 2131x.31	Ring	#374	Southern
Specimen #347	Museum of Northern Ariz.	932 NA 2134T.70a	Ring	#305	Southern
Specimen #348	Museum of Northern Ariz.	932 NA 2134T.75	Ring	#305	Southern
Specimen #349	Museum of Northern Ariz.	932 NA 2k34T.706	Raw material	Minnesota	Northern
Specimen #350	Museum of Northern Ariz.	932 NA 2134T.124e	Long bead	#374	Southern
Specimen #350a	Museum of Northern Ariz.		Short bead	#374	Southern
Specimen #351	Museum of Northern Ariz.	932 NA 2134T.136e	Raw material	#303	Southern
Specimen #352	Museum of Northern Ariz.	932 NA 2134T.150a	Pinkish bead	#374	Southern
Specimen #353	Museum of Northern Ariz.	932 NA 2k34T.154h	Raw material	#374	Southern
Specimen #354	Museum of Northern Ariz.	932 NA 2134T.154i	Cylinder	#305	Southern
Specimen #354a	Museum of Northern Ariz.		Bead	#305	Southern
Specimen #355	Museum of Northern Ariz.	932 NA 2134T.210	Raw material	#374	Southern
Specimen #356	Museum of Northern Ariz.	932 Na 2134T.234c	Raw material	#374	Southern
Specimen #357	Del Rio (Mr. Morgan)		Raw material	#372	Southern
Specimen #357a	Del Rio (Mr. Morgan)		Raw material	#372	Southern
Specimen #358	Southwest Museum	L-75-45	Pipe	Minnesota	Northern
Specimen #359	Southwest Museum	630-G-156a	Pipe	Minnesota	Northern
Specimen #360	Southwest Museum	228-L-108	No. Iowa pipe	Minnesota	Northern
Specimen #361	Southwest Museum	423-G-17	Pipe	Minnesota	Northern
Specimen #362	Tuzigoot Museum	IR 5245	Tubular pipe	#375	Southern
Specimen #363	Tuzigoot Museum	none	Raw material	Jasper	
Specimen #364	Tuzigoot Museum	none	Raw material	#375	Southern
Specimen #365	Tuzigoot Museum	none	Raw material	#375	Southern
Specimen #366	Tuzigoot Museum	none	Raw material	#374	Southern
Specimen #367	Smoki Museum	1359	Pendant	#374	Southern
Specimen #368	Smoki Museum	2149	Pendant	#374	Southern
Specimen #369	Smoki Museum	1368	Pendant	#300	Southern
Specimen #370	Smoki Museum	2003	Pendant	#303	Southern

Among those specimens which do not resemble the standards the following similarities were found: Specimens #339, 337 and 373 show marked resemblances. Specimens #362 and 365 show resemblance to each other. The remaining specimens—#338, 340, 341, and 343 are different.

It is to be regretted that more material from South Dakota and

Wisconsin was not available for this investigation. The writer wishes to take this opportunity to say that he is eager to obtain material from authentic sources in these states in order that he may verify the assumed constancy of silver, upon which the differentiation between artifacts from Minnesota and South Dakota was made. It must therefore be borne in mind that this subdivision of northern materials is subject to revision pending further work with additional catlinite.

The application of mineralogical and spectrographical methods to archaeological problems is not entirely new.[32] The preliminary work of this investigation has shown that it is possible to examine museum artifacts and from the data obtained assign them to two type groups. These groups, northern and southern materials, may be subdivided at the present time into the following varieties: northern, into Wisconsin or Minnesota and South Dakota; southern into Del Rio or not Del Rio, exact source unknown. Thus it is important that materials from additional sources be procured and examined in order that more accurate assignments can be made which will ultimately throw much light on the questions of travel and exchange among our prehistoric people. The prevalence of pipes and shale artifacts in museums throughout the country offers a fertile field for this research.

An extension of this work has already been outlined and a program, with the foregoing objectives in mind, is now under way. Any aid or assistance in the procuring of authentic source materials will be greatly appreciated.

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[32] Kidder, A. V. and Sheppard, A. O., *The Pottery of Pecos*, Vol. II, p. 530, 1936.
Caywood, L. R., and Spicer, E. H., *Tuzigoot, The Excavation and Repair of a Ruin on the Verde River near Clarkdale, Arizona*, 1935, pp. 109–111. Spectrographic examination by Morris G. Fowler.

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Claremont Colleges
Claremont, California
March, 1939

HARLAN INGERSOLL SMITH

W. J. WINTEMBERG

HARLAN INGERSOLL SMITH, former Chief Archaeologist of the National Museum of Canada, died on January 28, 1940. He was born in East Saginaw, Michigan, February 17, 1872. As a boy he became interested in the many evidences of the former Indian inhabitants scattered over the fields near his home and he formed a small collection of archaeological material. The first opportunity to do actual field work came in 1891, when the late Professor Putnam, Chief of the Anthropological Department of the World's Columbian Exposition in Chicago, employed him to assist Dr. Charles Metz in the exploration of the well-known Madisonville Village Site in Ohio. This was followed in 1892 by field trips to other sites in Ohio; in 1893 to mounds near Madison Wisconsin, and in 1894, as explorer for the Archaeological Institute of America, to Kalamazoo, Michigan, to investigate the so-called "garden-beds" near that place. In 1895 he joined the staff of the American Museum of Natural History, and that same year was in charge of the exploration of the Fox Farm site, near Mays Lick, Kentucky. He was Archaeologist of the Jesup North Pacific Expedition of the American Museum of Natural History and in 1897, 1898, and 1899 carried on explorations in British Columbia. He was in the Yakima Valley, Washington, in 1903. From 1907 to 1909 he made investigations in Wyoming, Alaska, and British Columbia.

Mr. Smith was Curator of the Anthropological collections of the University of Michigan from 1891 to 1893; Assistant Curator from 1900 to 1910, Associate Curator in 1911, and Honorary Curator in 1912 and 1913 of the American Museum of Natural History; and lecturer to the New York Board of Education from 1898 to 1911, and to the Pratt Institute in 1906 and 1907.

In 1911 Mr. Smith was appointed Archaeologist in the newly-created Division of Anthropology, Geological Survey of Canada. Here he remained until his retirement in 1937. During his connection with the National Museum of Canada he carried on explorations from British Columbia to the maritime provinces, devoting part of the time to ethnological investigations and totem pole restoration. The most important sites excavated by him were near Merigomish, Nova Scotia.

In 1930, in recognition of his many contributions to archaeological science, he received an honorary Master of Arts degree from the University of Michigan, where he was a student in 1891 and 1892. He was

one of the founders of the American Anthropological Association and a member of the following scientific societies: American Association for the Advancement of Science (Fellow), American Ethnological Society (Fellow), American Association of Museums, Michigan Academy of Sciences, Davenport Academy of Sciences, Canadian Geographical Society (Fellow), and corresponding member of the Anthropological Society of Washington, the Société d'Anthropologie de Paris, and the Geographical and Anthropological Society of Sweden.

He was married to Helena Elizabeth Oakes November 25, 1897, and had two children.

In Canada Mr. Smith will be remembered chiefly for his organization of the archaeological work in Canada, for bringing together a vast amount of information in the archaeological files of the Division, which might otherwise have been lost to science, and for inaugurating the weekly lectures to school children and adults.

Those closely connected with him will not soon forget his kindliness.

Owing to lack of space a list of only a few of Mr. Smith's publications can be given here.

1899 "Archaeology of Lytton, British Columbia." Memoirs of the American Museum of Natural History, Part III, whole series, Vol. II, Anthropology, Vol. I, The Jesup North Pacific Expedition, Vol. I, Pp. 129–161.

1900 "Archaeology of the Thompson River Region, British Columbia." Memoirs of the American Museum of Natural History, Part VI, whole series, Vol. II, Anthropology, Vol. I, The Jesup North Pacific Expedition, Vol. I, Pp. 401–442.

1901 "Cairns of British Columbia and Washington." Memoirs of the American Museum of Natural History, Part II, whole series, Vol. IV, Anthropology, Vol. III, The Jesup North Pacific Expedition, Vol. II, Pp. 55–75.

1903 "Shell-heaps of the Lower Fraser River, British Columbia." Memoirs of the American Museum of Natural History, Part IV, whole series, Vol. IV, Anthropology, Vol. III, The Jesup North Pacific Expedition, Vol. II, Pp. 133–191.

1907 "Archaeology of the Gulf of Georgia and Puget Sound." Memoirs of the American Museum of Natural History, Part VI, whole series, Vol. IV, Anthropology, Vol. III, The Jesup North Pacific Expedition, Vol. II, Pp. 301–441.

1910 *The Prehistoric Ethnology of a Kentucky Site.* Anthropological Papers of the American Museum of Natural History, Vol. VI, Part II, New York.

1929 *The Archaeology of Merigomish Harbour, Nova Scotia.* Bulletin No. 47, Anthropological Series, No. 9, National Museum of Canada, Department of Mines, Ottawa, Pp. 6–104.

Ottawa, Ontario
May, 1940

FACTS AND COMMENTS

"SALT PANS" FROM THE SOUTHEAST

"Salt pans" commonly occur throughout the Mississippi drainage area, especially in Southern Illinois, Kentucky and Tennessee where they often are associated with salt springs. Most frequently referable to numerous foci of the Middle Phase, Mississippi Pattern they are typical especially of the Gordon-Fewkes Aspect. Recent work under the sponsorship of various governmental agencies (Work Projects Administration, Tennessee Valley Authority, National Park Service) has somewhat extended the known range of this ware to include almost all of the region west of the Appalachians and East of Central Arkansas. It has not been found, however, to any extent in the Gulf Coast or

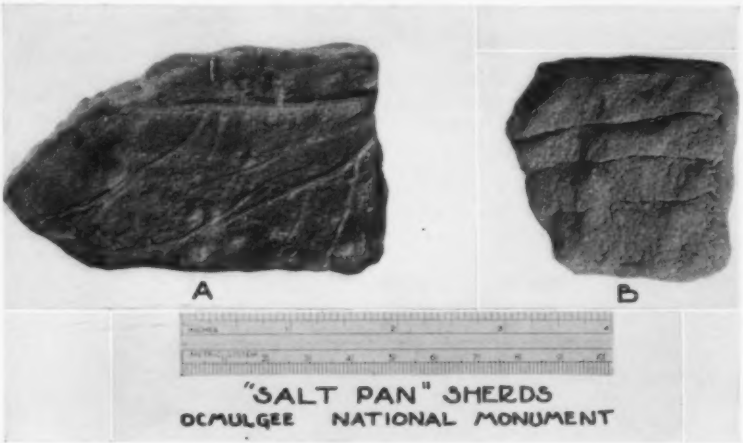

FIG. 6.

Great Lakes areas to the south and north. Together with the increased areal distribution, a number of additional details concerning manufacture and decoration have come to light.

The typical "salt pan," round or oval, is eighteen to twenty-four inches in diameter and from four to six inches deep with slightly sloping sides. The rounded lip usually is slightly thickened or folded, but has a considerable variation of detail, which may have some significance for focal determinations. The vessels are always shallow, usually with a flat base although very shallow rounded bases occur rarely. As described by Holmes[1] the surface is impressed with a twined open-work fabric. The various weaves exhibited can not be discussed at this time, but it has been assumed that this fabric impression was evidence that the vessels were constructed within a fabric-lined pit. This fabric was pre-

[1] Holmes, W. H. "Aboriginal Pottery of the Eastern United States" *Twentieth Annual Report*, Bureau of American Ethnology, pp. 27–31. Washington, 1903.

sumably used to lift the pan after air-drying. This hypothetical technique seems to be well suited to the size and weight of these vessels, but at present other types of surface finish are known. Plain "salt pans" have been found throughout the area and recently both complicated stamp and leaf impressed types have been found. Fig. 6, *A* shows a grit-tempered "salt pan" sherd bearing the impression of a large leaf, probably oak. This would suggest manufacture in a leaf-lined pit except that in this case the method of lifting is not apparent. Complicated stamped sherds must have been stamped after removal from the pit. The plain vessels are poorly smoothed on the exterior as might be expected in large heavy objects difficult to manipulate. While these surface finishes suggest variations in technique of manufacture or finishing, the important point seems to be that various techniques, some of them alien, such as stamping, were applied to the surface of "salt pans."

The most radical departure is in the matter of coiled vessels. At Ocmulgee National Monument[2] a large number of fabric marked,[3] plain,[4] and a few leaf marked sherds have been collected from the Macon Plateau and Brown's Mount Components of the Macon Focus.[5] This is an early Middle Mississippi manifestation most closely related to the Irvin, Harris and Lea components of the Small Log Town House Focus described by Webb.[6] The correspondence is especially close in the pottery traits listed by Griffin.[7] A high percentage of the three sherd types show coil fractures, usually at the junction of base and wall, although they do occur throughout the wall. The flat bottom seems to have been a large circular plate to which the coils were attached. Fig. 6, *B* shows a plain "salt pan" sherd (McDougal Plain) in which the coils have been pinched together slightly but not entirely obliterated on the exterior. While this seems to be an unusual case, it is typical of the poorly finished exterior of McDougal Plain. In a large sample from the Macon Plateau the coils range from 10 to 20 mm. deep and 8 to 15 mm. thick. Coil fractures are most common in grit-tempered sherds and rare in the shell-tempered ware. It has been observed that in other pottery types grit-tempered sherds are more apt to show coil fractures than shell tempered sherds even where the decoration, shape and, presumably, methods of manufacture are the same. Apparently shell temper permits a closer bond between successive coils.

The evidence of coil fractures and unobliterated coils points very definitely towards a circuit coil construction. This does not necessarily eliminate the pit method of manufacture but, at least, it does indicate that the common technique for most pottery vessels in this area was used for containers of markedly different size, shape and probable use. The surface finishes such as smoothing and stamping also indicate that upon occasion the methods commonly used on other types of containers were transferred to the "salt pan." This suggests that at least outside of the salt spring area in and around Kentucky, the vessel form was retained but that they were not set off from other vessels by a distinctive type of decoration. It is logical to assume that in and around Kentucky at least

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[2] "Preliminary Report on Archaeological investigations at Macon, Georgia." A. R. Kelly, Bulletin 119, Bureau of American Ethnology, p. 22, plate 11 B. Washington, 1938.

[3] Hawkins Fabric Marked "Excavation of Mound 'C', Macon Group," Charles H. Fairbanks. Unpublished manuscript prepared for National Park Service.

[4] McDougal Plain "Excavation of Mound 'C', Macon Group," Charles H. Fairbanks. Unpublished manuscript prepared for National Park Service.

[5] Kelly, A. R., *op. cit.*, pp. 1–68.

[6] Webb, Wm. S. *An Archaeological Survey of the Norris Basin in Eastern Tennessee.* Bureau of American Ethnology, Bulletin 118, Washington, 1938.

[7] Griffin, James B. in Webb *op. cit.*, 1938. Pp. 253–358.

the larger "salt pans" were made in pits and used in salt manufacture. The variation of decoration and possibly construction in peripheral areas suggests an acculturation process in which the basic form was retained but the function may have been lost.

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PLASTIC CLAY

For several years I have been using a composite material for the restoration of museum specimens of many kinds. It has proven useful in the repair of a wide variety of substances, including pottery, stone, oxidized metals, bone, and ivory. It may be used wherever a strong substance is needed to fill in missing parts and to make a bond with the original pieces. It is easily prepared and used, and has many advantages over the usual repair materials. The chief of these is that it is very strong, though light; and when dry, very hard, yet completely reconvertible without damage to the specimen. Moreover, it does not shrink in drying.

I refer to this composite material, for want of a better name, as plastic clay. It has two ingredients: polymerised vinyl acetate (a synthetic resin which is described in detail at the end of this article), and powdered clay or muddy sand of 200 mesh fineness. Gypsum, plaster of paris, whiting, kaolin, or any equally fine clay or sand may be used. It is better to avoid anything finer than 200 mesh, as the use of so fine a substance presents numerous difficulties. The vinyl acetate is a 25 per cent solution of 15 viscosity in ethyl alcohol, and is prepared over a steam kettle as described at the end of the article.

To make plastic clay, lay the finely powdered clay on a glass palette. Make a pocket in the clay and into this pour the vinyl acetate. Work the clay into the vinyl acetate with a spatula until the mass is quite stiff, about the consistency of plasticene. In this stage it may be picked up in the hands and more clay may be folded in until the mass does not feel tacky. It is now ready for use, and may be stored away and kept indefinitely in an air-right container. I have found in practice that a layer of cloth saturated in alcohol and placed over the plastic clay before sealing will keep it in excellent shape and ready for use at any time.

Plastic clay may be used in any repair in which missing parts have to be filled in. Handle the plastic clay exactly like modelling clay. Support the existing parts of the restoration in their proper relationship by any convenient means. The edges of the gap to be filled should be brushed with one or two coatings of the vinyl acetate thinned with acetone alcohol to a 10 or 15 per cent solution. This will give a complete plastic bond between the two surfaces, for the thinned-out vinyl acetate penetrates the pores of the material under repair, and while still soft will actually flow and become a part of the plastic clay that is about to be added. After the surfaces have been brushed, the gap to be filled is bridged by a mass of plastic clay of appropriate size. As long as it remains moist it may be shaped or tooled exactly like modelling clay. It will bridge a very large gap or fill the finest crack. But when dry it will be extremely hard and strong. In the process of drying, it will not draw away from the edges that have been joined. If, for any reason, it should be necessary to withdraw the repair, the plastic clay can be removed at any time with the help of any solvent of vinyl acetate without danger to the specimen itself. If the process of filling in gaps leaves any excess clay which has hardened, it may be removed by rubbing it with acetone alcohol applied to a cloth. Or, if there is need for more clay after the first application has hardened, it will adhere if the hard surface is first moistened with alcohol.

If designs are wanted on the hardened clay, they may be cut in with sharp tools. Although the task is difficult because of the hardness of the material, it can be accomplished without danger of cracking the clay or chipping the surface. It is much easier to tool the surface when the clay is still soft.

If colour is wanted in the repair, the restorer may colour the clay either when he is first mixing it or after the clay has hardened. In the first case, simply add dry colour pigments to the soft clay, bearing in mind the fact that the colour tends to lighten several shades when it dries. To apply colour after the clay has hardened, disperse the dry pigments in alcohol. A small amount of vinyl acetate may be added, but it is not necessary. The colour with alcohol may then be applied to the plastic clay with a soft brush, like a paint. The alcohol softens the clay just enough for the pigment to adhere.

In the restoration of pottery, plastic clay is useful for many operations. If nearly all of a vessel is present, but there are small holes that should be filled to give strength and a finished appearance to the restoration, plastic clay is suitable. Place a pancake of plasticene over the hole on the inside of the pot. Then coat the edges of the hole with dilute vinyl acetate and fill in the hole with plastic clay as described above. While still wet, the clay can be shaped to the contour of the vessel and, if desirable, any design can be tooled in. Such a repair will dry in about four hours.

In cases where a great many sherds have been joined together to make a complete pot, the edges of the sherds are in most cases rough and pitted. This is especially true of grit-tempered pottery. The edges of sherds of this type have a tendency to crumble away leaving cracks and holes along the joins that will mar the appearance and weaken the vessel. Here plastic clay will be found most useful. After coating the edges of the cracks with dilute vinyl acetate, moisten the plastic clay with a little additional alcohol and press it into the cracks with a wooden or steel spatula. To yield a smooth surface, the spatula should be kept wet with alcohol. If care is taken during the process not to overlap the edges, and to model the design and shape while the clay is still wet, there is nothing more to do when it has hardened.

It is difficult to describe the necessary procedure for the restoration of pottery in which a large portion of the vessel is missing. Each restoration of this type presents difficulties of its own, and these have to be overcome mainly by the skill and experience of the restorer. If much of the pot is missing, a mould must be used to give the contour of the missing portion and support the plastic clay while it is drying. I have been using a technique which is somewhat similar to that described by Douglas S. Byers in the Society for American Archaeology "Notebook" for February, 1940. Where all, or nearly all, of one side of a pot is present, I build up a plaster cast of the outside, using liquid latex as a separator between the pot and the plaster. The cast can be removed and placed in successive positions around the circumference of the vessel while missing portions are replaced by plastic clay applied to the inside of the cast. If it is necessary to reconstruct the bottom, it is advisable to put the vessel on a turn-table and build up the bottom to the original shape in modelling clay or plasticene. A piece mould can then be made in plaster, and the modelling clay or plasticene can be removed and replaced by plastic clay. If this procedure is followed, a separator is required between the plastic clay and the plaster mould. I use liquid latex, thinning the latex with water and brushing it on the inner surface of the mould. The result, of course, is to deposit a thin layer of rubber on the mould. Another device is to apply several coatings of thin lacquer to the mould and then rub it with vaseline. In this manner, a fairly substantial separator will be obtained, but it is not as effective as latex. When the separator has been applied to the mould, and

the pieces are fastened into place, the plastic clay can be applied through the mouth of the vessel. Brush the edges of the pottery with dilute vinyl acetate, and take care to press the plastic clay firmly against them. Owing to the presence of the mould, it will take from 12 to 24 hours for the plastic clay to dry. After the mould is removed, the plastic clay may show fine cracks caused by the excessive use of alcohol during application. These are not serious and may be filled in with fresh plastic clay applied with a spatula. Any excess material or roughness can be removed by rubbing the hard clay with alcohol as previously described.

Although I do not use the wheel and template technique for reconstructing the pottery shape as worked out at the Milwaukee Museum and described in the pages of the Notebook, I believe that plastic clay would work with that technique as well as plaster of paris, and would have the advantage of being reconvertible should it ever prove desirable to take apart the restoration.

Anyone who would like further information on the preparation and use of plastic clay is invited to correspond with me.

Polymerized Vinyl Acetate

Polymerized Vinyl Acetate is a liquid ester which polymerizes to form a clear, colourless, odorless, tasteless, hard thermoplastic resin. It dissolves readily in suitable solvents for use as a lacquer or binding material. It is sold in Canada and the United States under various trade names, and is supplied in granular form so that it is readily soluble. It is transparent to ultra-violet light, hence the films do not break down or discolour even when exposed to strong sunlight. These synthetic resins are supplied at varying degrees of viscosity, ranging from 1.5 visc., which is the lowest, to 60 visc., the heaviest of the group. One can therefore have a resin which suits the purpose, as the low viscosity resin, having a fine molecule, can be used to advantage for the permeation of articles to add strength. The numbers which are given to the resins refer to the molecular size, and serve to distinguish the degrees of polymerization from one another. The low viscosities, such as 1.5 and 2.5 are not of much use as binding mediums. For this purpose the medium viscosity resins are best suited:—7, 15 and 25 viscosity.

For use as binding medium with powdered clay. To form what I have called plastic clay, I find the 15 visc. the best suited, and prepare it as follows. Pour 1000 cc. of Ethyl alcohol into a glass flask. Add 250 grams. of vinyl acetate, 15 visc. Place stopper in flask and let stand overnight. Remove the stopper. Then place the flask and contents over a steam bath until the vinyl acetate is thoroughly dissolved. It is ready for use when cool.

This same mixture has many other uses, such as the hardening of pottery sherds. A film of vinyl acetate is not as glossy as a like film of dammar, shellac or mastic, and when applied to a surface it does not darken the surface as much as do the ordinary resins. It dries by polymerization, and does not, therefore, break down and eventually crack in the manner of ordinary resins, which dry by oxidation.

Vinyl acetate has many other uses; and, with practice, and a thorough understanding of its properties, one can find an unlimited field for this absolutely water-clear resin.

The following are the solvents of vinyl acetate:

Completely soluble in:	*Insoluble in:*
Ethyl alcohol	Water
Methyl alcohol	Coal tar naphthas
Diacetone alcohol	All petroleum fractions

Completely soluble in:	*Insoluble in:*
Acetone	Turpentine
Ethylene dichloride	Xylol
Benzol	Ether
Toluol	
Carbon tetrachloride, etc.	

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THE ORIGIN OF SOME POLISHED STONE ARTIFACTS[1]

Polished stone artifacts, found in many parts of the world, are widely cited as evidence of the patience and manual dexterity of primitive man. Investigation of the polishing scratches on the surfaces of a number of stone hammers strongly suggests that the polish is of natural origin, a conclusion supported by the difference between this polish and that in the hafting grooves, known to be man-made. (Fig. 7)

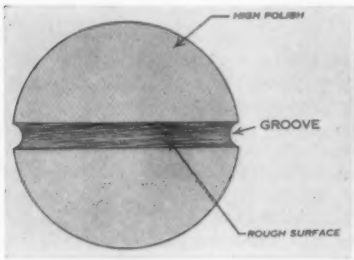

FIG. 7.

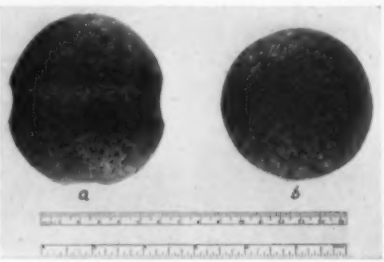

FIG. 8.

FIG. 7.—Diagram showing types of polish on a typical stone hammer.

FIG. 8.—Polished stone hammer and pothole "grinder." *a.*—Brown granite hammer from Emory Ranch Ruins, La Plata River, Colorado. The surface of this hammer is very smooth, and the few remaining polishing scratches are "random." The groove is decidedly rough, and the scratches are "ranked." (#558, Morris Collection, University of Colorado Museum). *b.*—Dark gray granite-gneiss "grinder" from a pothole in Paradise Park, Grand County, Colorado. This is an almost perfect sphere, with a very smooth surface, having "random" polishing scratches. (Site #155, 1939.)

Scratches found on the surfaces of many stone artifacts have a "true random" arrangement, almost exactly resembling that found on the surfaces of stream bowlders and pothole "grinders." Those on surfaces polished by most mechanical methods are "ranked"—the scratches are arranged in parallel series, much like those on a sandpapered surface. "True random" polish can be produced mechanically only with devices such as a tumbling barrel, which is almost certainly unavailable in any neolithic cultural group.

[1] The field work here described was supported by a grant from the Penrose Fund of the American Philosophical Society.

It seems probable that primitive man in many instances did not polish the entire surfaces of his implements, but merely cut hafting grooves into natural bowlders that he found. Natural rock forms occasionally suitable for use as hammers, etc., are:—

1. Stream bowlders
2. Pothole "grinders"
3. Concretions
4. Gastroliths, geodes, "agates," and other occasional forms.

Stream bowlders occur in all shapes, but commonly are so badly asymmetrical that they are unsuitable for use as heads for hafted tools. These, to "swing" properly, must be symmetrical about a plane containing the major axis. However, as stream bowlders are plentiful, a few in almost any stream bed may have the requisite properties. In a bowlder-bedded stream channel, an observant man can usually find several dozen potential stone hammers during a day's search.

Pothole grinders are usually rounded and symmetrical, the most common shapes being ovoidal, ellipsoidal, and spheroidal. Perfect spheres are not uncommon. A field investigation of numerous potholes at the headwaters of the Colorado River, in Middle Park, Colorado, disclosed that more than 60 per cent of the "grinders" found needed only grooving and hafting to be made into usable, and usually well balanced, hammers. Although potholes are not exactly common features of most stream channels, and are often concealed from view by water, they are rather easy to locate, as a "working" pothole has a characteristic growl, often audible at a considerable distance. A spheroidal stone hammer and a typical pothole "grinder" are shown together in Fig. 7.

Concretions occur in all sizes, and in almost every imaginable shape, but are commonly roughly spheroidal. Most concretions are too brittle for continued use as hammers, and would not, in general, last long enough in use to repay the labor of grooving and hafting them. This brittleness, however, in no way interferes with the use of concretions as weapons, a lime-cemented sand concretion, properly hafted and vigorously swung, being just as effective a skull-cracker as a similar piece of granite similarly used. Most concretions, although brittle, would not be shattered by violent contact with a yielding object, such as a man's head.

Gastroliths, geodes, "agates," and other miscellaneous rock forms, when of the proper shapes and dimensions, could, and probably did, furnish the "raw materials" for the manufacture of stone tools, but no specimens in the collections studied could be traced to these origins with any confidence.

For distinguishing between natural and man-made polish on artifacts, the following criteria, which appear valid in most instances, are suggested:

Absence of polishing scratches indicates that the surface was produced by chemical action, and suggests that the artifact was originally a concretion, geode, "agate," or gastrolith. Weathered artifacts, and those long-buried in peat bogs or caliche-saturated soils, may also lack recognizable polishing scratches.

"Random" polishing scratches indicate a surface polished by natural means, such as that of a stream bowlder or a pothole "grinder." So far as can be determined, no primitive polishing means can produce "random" scratches.

"Ranked" polishing scratches indicate a surface polished by man. Rubbing on a rock surface, or with wet sand on rawhide, produces typical "ranked" polishing scratches. Surfaces polished naturally by windblown sand may have "ranked" polishing scratches, but these will almost invariable be pitted.

"Ranked" scratches over "random" scratches suggest that a naturally-surfaced object

has been reshaped by man. Stream or glacial bowlders blasted by windblown sand may also have scratches of this type.

"Random" scratches over "ranked" scratches suggest than a man-polished object has later been exposed to natural polishing, as might occur when an artifact is lost in a stream.

According to these criteria, few of the polished stone implements found in the western United States can be said to have been polished by their makers. With some exceptions, it appears that the artifacts were natural rock forms, reworked, often with considerable skill, into exactly the desired shapes.

Lest roughness of hafting grooves be interpreted as evidence of lack of skill on the part of the artifact makers, it should be pointed out that a rough groove produces a tighter head than a smooth one. Among Plains Indians, hafting was apparently done by tying the head into a wet split stick with green hide. On drying, the hide shrank, pulling the stick into the groove with considerable force. Pueblo people, in general, used the "J" haft, and the Gila Valley people a "wrapped" haft. Under these conditions, roughness of the groove would suggest a competent toolmaker, rather than an unskilful stoneworker.

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DIAGNOSTIC FLINT POINTS

Several valuable classifications of flint points have been formulated but few of these have attempted to distinguish between those points having diagnostic value,[1] and the numerous forms which are found rather indiscriminately over a large series of cultures and which may or may not have value as cultural determinants.[2] Points which have been used by archaeologists as diagnostic determinants seem to be inseparably connected with distribution studies of complexes and traits. An illustration of this is the small finely chipped isosceles projectile point so diagnostic of the Middle Mississippi phase. This identical point is found in the Southwest where unfortunately it is found among several different cultures and in several different time horizons so that it does not have diagnostic value in this general area. Or again we might consider the highly diagnostic laurel leaf blade so typical of many components of the Red Ochre phase. This point crops out again in other situations where it is not believed to aid in distinguishing the cultural units in which it is found from other cultural units.

By and large many points have diagnostic value when they are considered in the light of associated cultural complexes and in the light of distributional studies. It is these that we are interested in describing.[3]

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[1] Any trait or complex that aids in distinguishing one cultural unit from another is considered as diagnostic.

[2] A point has a multiple trait index and may often be a sensitive indicator of a cultural unit. A classification of flint points might include a description of form, technique of chipping, type of chipping scars, and the nature of the flint or chert used in its manufacture. Four classifications that come to the author's mind are:

a. from pp. 87–94 of *An Introduction to Nebraska Archaeology* by W. D. Strong, Smith. Misc. Collections, vol. 93, no. 10, 1935.

b. from chapter IV of *Rediscovering Illinois*, by F. C. Cole and T. Deuel, 1937.

c. from an article on projectile point classification in the Jan. 1937 issue of AMERICAN ANTIQUITY, by J. J. Finkelstein.

d. from an article in the *Missouri Archaeologist* in the June 1937 issue by J. A. Eichenberger.

[3] The points illustrated in this article do not always represent the range of alternate forms existing in each instance.

Points typical of hunting and collecting cultures include the Borax Lake point[4] Fig. 9, *1;* the Lake Mohave point,[5] *2;* the Silver Lake point,[5] *3;* the Folsom point,[6] *4;* the Yuma point,[6] *5;* and the Gypsum point,[7] *6*. All of these points have been found under conditions of at least considerable antiquity and in association with other cultural objects in the West and Southwest denoting hunting or seed gathering culture or both. Often points similar to the Gypsum and Lake Mohave points are found in the Mississippi Valley with manifestations of the Woodland pattern but under conditions where they do not have diagnostic cultural value. The Yuma point has been found under conditions of considerable antiquity in Minnesota and also in the Southwest. The Folsom point is rather frequently picked up on the surface in the Mississippi Valley and its tributaries but only in the Southwest has it been possible to accredit it with relatively great age.[8]

Points typical of hunting and hoe cultures include the roughly chipped contracting base point[9] Fig. 9, *7*, the lanceolate blade,[10] *8*, and the small roughly chipped isosceles or curved flake projectile point[10] *9*. The contracting base point has an extremely wide distribution in the United States. It does not have a great deal of value as a cultural determinant, for it is found intermixed with cultural debris of most of the known prehistoric cultures. However, when found in large numbers in a site in the Mississippi Valley it is generally with objects all of which are assigned to the Woodland pattern. The lanceolate blade is generally restricted to manifestations of the Red Ochre phase although not always found in all the components. In the Northern and Middle Mississippi Valley the small roughly chipped isosceles projectile point is generally found among peoples who practiced the culture of the Woodland pattern who, it is generally believed, had come into contact with agricultural peoples of the Mississippi or Southern patterns. The form was apparently adopted but the coarse flake scars so characteristic, though not universal, of the Woodland pattern was retained. In the Mississippi Valley it is typically found with the Tampico phase.

Points typical of the sedentary and semi-sedentary agriculturalists of the Mississippi Valley are the finely chipped isosceles projectile point[11] Fig. 9, *10*, the same with multiple notches,[11] *11;* elongate serrated flint points,[12] *12;* the long finely chipped ceremonial flint,[13] *13;* the fish tail point, *14;* the Hopewellian point,[14] *15;* and the diamond shaped rather thin knife of the Upper Republican aspect,[15] *16*.

The finely chipped isosceles projectile points and the variants with multiple notches or tiny serrated edges seem to have been widespread among agricultural communities in the Mississippi Valley. In the Southwest they do not seem to have been diagnostic. In the Mississippi Valley and its tributaries, however, both the notched and unnotched

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[4] Harrington, M. R. "Folsom Man in California," *The Master Key*, vol. XII, no. 4, 1938.

[5] Campbell, E. W. and W. H., Antevs, E., Amsden, C. A., *The Archaeology of Pleistocene Lake Mohave*, Southwest Museum Papers, no. 11, June 1937.

[6] Fischel, Hans E. "Folsom and Yuma Culture Finds," AMERICAN ANTIQUITY, vol. IV, no. 3, Jan. 1939.

[7] Harrington, M. R. *Gypsum Cave Nevada*, Southwest Museum Papers, no. 8, 1933.

[8] The discovery of a stray Folsom point in manifestations known to have been later than the Folsom culture does not necessarily mean that people responsible for the manifestation made the point. It is quite possible that such a point was picked up and reused.

[9] Cole and Deuel, *op. cit.*, p. 53. By a contracting base point is meant here a point the stem of which contracts from the bottom towards the tip.

[10] *Ibid.*, p. 55.

[11] *Ibid.*, p. 56.

[12] Shetrone, H. C. *The Mound Builders*, 1931, p. 177.

[13] *Ibid.*, p. 438.

[14] Cole and Deuel, *op. cit.*, plate XXXII, B.

[15] Bell, E. H. *Chapters in Nebraska Archaeology*, vol. I, 1936, p. 46. This form often has an irregular outline.

varieties are held to be diagnostic of the Mississippi pattern, the former typical of the Upper and Middle phases, the latter typical of the Middle and perhaps the Lower phase. The elongate serrated flint point is typical of some components of the Fort Ancient

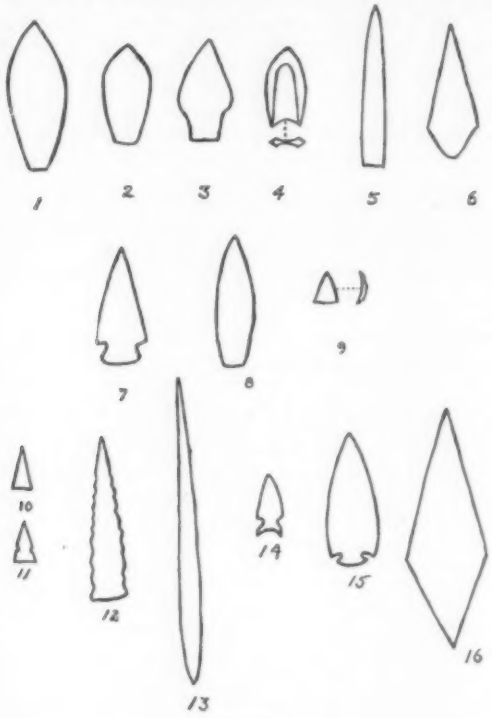

FIG. 9
(Scale; $\frac{1}{2}'' = 1\frac{1}{2}''$)

aspect. The long ceremonial spearpoint with relatively thin flake scars is characteristic of the large agricultural community of Etowah and other related sites. The fish tail point seems to be quite common among prehistoric settlements belonging to the Mississippi pattern in the near Southwest, as Oklahoma. The well-known Hopewellian point with its characteristic feather edge variety of flake scars and its distinctive stem is found particularly with the Ohio and Illinois manifestations of the Hopewell phase, but it is not necessarily found with the Hopewellian everywhere.

This list of points probably by no means exhausts the variety of flint points which have diagnostic value. Doubtless there are many others which could be added. What the

author wishes to stress here is that the examination and interpretation of flint points, especially in relation to other traits or complexes that determine cultural units bids fair to become a promising line of archaeological research in the future. Out of the welter of hitherto undistinguishable forms we are beginning to recognize many which have value when considered in relation to descriptions of archaeological cultures and their distribution.

ROBERT MCCORMICK ADAMS
St. Louis, Missouri

PECULIAR WOODEN TUBES FROM SOUTHEASTERN OREGON

During excavations in Catlow valley, southeastern Oregon, by the Department of Anthropology, University of Oregon, in the summers of 1937 and 1938, there were found

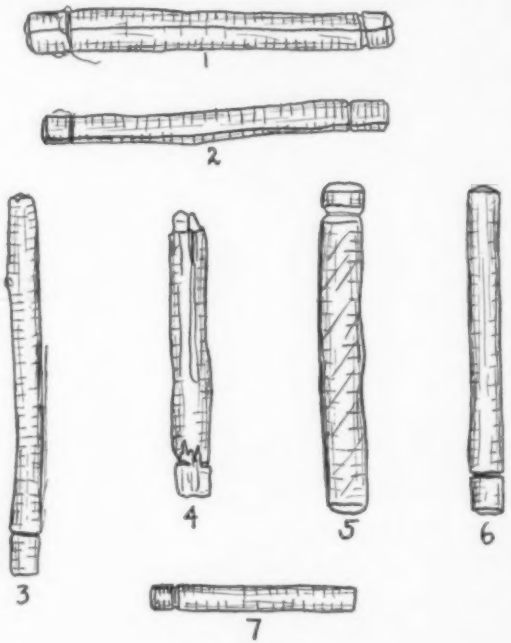

FIG. 10

seven peculiar wooden tubes, each with a shallow groove around one or both ends. The specimens, shown in Fig. 10, range in size from No. 7 which is 5.3 cm. long by .5 cm. in diameter, to No. 3 which is 10.0 cm. long and .7 cm. in diameter. The largest from the standpoint of bulk is No. 5 which is 8.8 cm. long and 1.2 cm. in diameter. This specimen

is the only one made from mature wood and not from short sections cut from small annual shoots. In each case the pith has been removed, leaving a clean bore the length of the section. No. 6, one of the most poorly made, apparently was never finished because the pith was never cleaned out, though it is evident that several small sticks were broken off during the attempt. Three specimens, Nos. 1, 2, and 4, of the same Figure, which have grooves around both ends, apparently were slit lengthwise to facilitate removing the pith, then tied back together, or they were accidentally broken in pushing out the pith and then tied together again. In two cases sinew binding is still in place as shown. No effort has been made to decorate these by painting. Nos. 1, 2, 3, and 4 have not been stripped of their bark.

Are these beads, gambling pieces, pipe stems, or what? The Department of Anthropology of the University of Oregon would be very grateful to receive any suggestions concerning the use of these puzzling artifacts.

ROBIN DREWS
University of Oregon
Eugene, Oregon

CORRESPONDENCE

SANDIA CAVE

Dr. Donald D. Brand's remarks in AMERICAN ANTIQUITY, Vol. V, No. 4, p. 339, "Regarding Sandia Cave," clearly require my response. It is possible that my original article in AMERICAN ANTIQUITY, Vol. V, No. 3, p. 200 ff., which presumably precipitated these comments, may have left some points obscure.

In the first place, I emphatically reaffirm my statement concerning *the rodent disturbances below the stalagmitic layer in the front portion of the cave.* This was plainly stated in my article and will be defended by me against any and all possible attacks as unimpeachable historical evidence. There was a natural fissure within the stalagmitic layer in the vicinity of the fire hearth through which rodents could readily pass into the area below. Moreover, there was also a break through the stalagmitic layer a few feet farther back in the cave, undoubtedly of human origin, which was properly noted as such by me before excavations began. Channels connected both of these breaks with the underlying deposits where rodent dung, piñon nut shells, small fragments of paper, burned matches, and small sticks of wood were found. Furthermore, fragments of bones of pleistocene mammals, undoubtedly scattered by rodents, appeared over the surface of the most recent deposits. At the time of my excavations in Sandia Cave, I called these sundry evidences of rodent disturbances to the attention of Dr. Frank C. Hibben. Photographs in the files of the University of New Mexico, field notes, and the testimony of assistants who worked in the cave with me, will substantiate my statements on the observed facts. I reiterate that the disturbances noted by me do not in any way invalidate the evidence of an antecedent occupation of the cave by man, as indicated by the position of the fire hearth practically on the virgin floor. Nor does it necessarily follow that similar disturbances need have existed elsewhere in the cave. In the face of the positive evidence it is exceedingly difficult to appreciate the motive or purpose of Dr. Brand's emphatic denial of any rodent disturbances occurring below the stalagmitic layer. Such a denial may easily cast doubt upon the authenticity of other finds made in the Sandia Cave.

Dr. Brand's communication also states: "There is, on the other hand, definite evidence that the entrance to the cave was sealed at least once during its history." My article implied nothing to the contrary, since I *did* find criteria suggesting that the cave may have been sealed at one time. Dr. Brand's comment was evidently provoked by the following sentence in my article: "There is no indication that the opening to the cave was sealed between the time of deposition of the lower and upper strata, thus showing that the almost pure calcite layer probably was not formed by ground water." This might have been more clearly stated by me, but careful reading will reveal the implication that the cave was not sealed at the time of the formation of the calcite (stalagmitic) layer. I did not say anything as to whether or not the cave was sealed before or after that period.

The discussion in my article was based upon the formation of the stalagmitic layer which I recorded as appearing throughout the cave. The stratigraphy for the loci given in the text and illustrated in the two accompanying plates is *complete* and *correct*, any exceptions by Dr. Brand or others to the contrary notwithstanding. During my excavations, the sediments were followed from the surface to the natural limestone floor of the cave, and I did not think it necessary to blast into the virgin rock. According to *Time*, May 6, 1940, Dr. Hibben reported finding Folsom points below the stalagmitic layer and

above a sterile layer of yellow ochre in other portions of the cave. Dr. Hibben further reported the occurrence of Sandia point types below the sterile ochre layer. Such additional data do not in the slightest alter the thesis of my article which, as already stipulated, is concerned with the significance of the stalagmitic layer. I specifically stressed the nature of my partial excavations, and made allowance for further possible finds beneath the stalagmite. However, no amount of additional finds can invalidate the thesis that the wet period within the cave during the formation of the stalagmitic layer was preceded and followed by drier periods. Numerous tests were made by me throughout the cave and their results corroborated this deduction.

In October, 1935, Mr. Ken Davis of Albuquerque brought to my attention two caves in Ellis Canon in the Sandia Mountains. Dr. Hibben collaborated with me in the initial excavation of both caves until June, 1937. During my work at Sandia, I not only excavated in the front portion of the cave, but also in the central part and in the rear; moreover, I also made a number of tests throughout the length of the cave. This is not in full agreement with Dr. Brand's statement "Mr. Bliss worked for a brief period in the somewhat disturbed front portion of the Sandia cave . . ."

In conclusion, I should like to make a correction concerning the photographs accompanying my original article. Galley proofs never reached me, due to conditions beyond the control of both editor and author. Unfortunately the captions under the photographs were reversed in printing. The caption "Deposits toward front of Sandia Cave," etc. should read, "Deposits toward rear of Sandia Cave," etc. and vice versa.

WESLEY L. BLISS
Department of Anthropology
University of Pennsylvania

A REPLY TO "FOLSOM AND NEPESTA POINTS"

Some of the statements in the article by Charles Scoggin in the last issue of AMERICAN ANTIQUITY are incorrect and the whole article is open to the criticism that it creates an erroneous impression of what workers in the area have said concerning the question of a Folsom culture in California.

In his reproduction (Fig. 13, 7A) of Heizer's illustration of the basal end of a projectile point found at Tracy Lake in Sacramento Co., California, by E. J. Dawson, Scoggin has appended the caption "actual length 1¼" width 1½"." He has apparently arrived at this estimate of size by measuring Heizer's illustration which was enlarged to show detail. Heizer clearly states in the text that the specimen is 25 mm. wide and 21 mm. long.

Secondly, throughout his article Scoggin implies that Heizer has contributed to "the suggestion that the parts of the Folsom complex will be found to be as generally widespread west of the Rocky Mountains as they have been to the eastward." This is not the case if we may judge by what Heizer has written. In fact Heizer's statement that "typological considerations, then, might appear to indicate that these demonstrate an attentuated 'Folsom' technique, yet the total cultural complex, of which these points are but one component, indicates a developed culture whose tenor is already definitely Central Californian" is a caution against drawing conclusions based on typological similarities between individual cultural elements taken out of their context, and concurs with Scoggin's statement that "a case for the presence of the Folsom complex has yet to be established west of the Rocky Mountains."

In the third place Scoggin has confused Heizer's description of the Tracy Lake

specimen as "Folsom-type" with his description of other types of concave base points from Central California to which Heizer nowhere appends an adjectival Folsom, Folsomoid, or Folsom-like. Heizer is explicit in his statement that these other points are elements in a typically Central California culture complex and they they have been found chiefly in sites of the Transitional Horizon.

Finally Scoggin's suggestion "that the so-called Folsom and Folsom-like points from the Borax Lake site and the points described from the Sacramento Valley . . . should henceforth be referred to as Nepesta or Nepesta-like" is impractical. We have long used a modification of W. D. Strong's typological classification for projectile points. Concave base points, are called type NAb3 and to this we add qualifying phrases to indicate special features such as "diagonal flaking," "basal thinning," and "channel groove."[1] The concave base points illustrated and described by Heizer represent four different types none of which is identical to the type represented by the Nepesta point. To name them for the Nepesta point would create the same problem as has the indiscriminate use of the term Folsom.

FRANKLIN FENENGA
Lillard Museum
Sacramento Junior College

A NOTE ON FOLSOM AND NEPESTA POINTS

Mr. Scoggin's earnest attempt to bring some order out of the chaos of the Folsom problem appeared in the preceding number of AMERICAN ANTIQUITY (Vol. V, pp. 290–298). His attempted clarification of the issue falls somewhat short of the mark, although many will agree with his main conclusion, viz., that too wide an application of typological catchwords which contain the word "Folsom" or "Folsom-like," etc., may lead to confusion if uncritically used. When Mr. Scoggin (p. 296) claims priority of the type name "Nepesta" or "Nepesta-like," he must realize that he is introducing a further classificatory term which increases the already large number of such, and upon which there is no universal agreement as to application. Most workers are abiding by the decision and recommendations of the Symposium on Early Man held at Philadelphia in 1936. Including myself in the latter majority class, I register an objection to the implication by Mr. Scoggin that I was either implying or stating directly that I believed true Folsom type points, or a Folsom culture complex was represented in my short paper in the Southwest Museum *Masterkey* (Vol. 12: 180–182, 1938). Indeed, because I saw a danger in the uncritical use of the word "Folsom," I stated in this paper (p. 182), "Typological considerations, then, might appear to indicate that these [flaked points] demonstrate an attenuated 'Folsom' technique, yet the total cultural complex, of which these points are but one component, indicates a developed culture whose tenor is already definitely Central Californian." In another publication,[1] this same caution has been expressed (p. 75); " . . . we hesitate to infer age from the surface find of a Folsom-like point . . . in the valley. It is highly hazardous to transfer time through distance and space on the questionable basis of typological similarity. In order to judge whether or not a Folsom culture in the true sense) is present, we must see it in its stratigraphic position; it must occur in context." Obviously Mr. Scoggin has either misunderstood me, for we are in essential

[1] Lillard, J. B., Heizer, R. F., and Fenenga, F. *An Introduction to the Archeology of Central California*, Sacramento Junior College Department of Anthropology Bulletin, 2. 1939.

Heizer, R. F. and Fenenga, F. "Archaeological Horizons in Central California." *American Anthropologist*, Vol. 41, No. 3: 378–399. 1939.

agreement, or, and this is most likely, he has not seen the Sacramento Junior College publication.[2] Typologies can be exceedingly misleading unless properly used: for example, Graebner based his theory in large part upon certain criteria of typology or classification, and the weapons with which his position was assailed (e.g., by R. B. Dixon) were the safeguards which the majority of American anthropologists, who subscribe to the "historical method," employ. Perhaps not enough archaeologists have read Sapir's *Time Perspective in Aboriginal American Culture.*

I make no attempt to explain the Borax Lake finds; they seem unconvincing at the present time due to the lack of information regarding their occurrence.[3]

ROBERT F. HEIZER
University of California
Berkeley, California

AN ACKNOWLEDGEMENT

In a publication of mine, "Cultural Relationships of Archaeological Sites in the Upper Great Lakes Region," *Papers of the Michigan Academy of Science, Arts, and Letters,* Vol. XXIV, Part IV, 1938, pp. 1–10, I was indebted to W. C. McKern for the aspect, foci, and components of the Lake Michigan Phase of the Woodland Pattern, and the Oneota Aspect of the Upper Mississippi in the state of Wisconsin. This information, given to me by McKern in correspondence of April 8, 1938, should have been listed in the bibliography.

E. F. GREENMAN
University of Michigan

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[2] In this bulletin (see also the *American Anthropologist* 41: 378–399, 1939) we make no claim of having found a Folsom culture complex. By the same token, had we used the term Nepesta as a type name, we should not have claimed that it indicated the existence of a Nepesta culture. In other words, the critical point it not *what* term one uses, but *how* he uses it.

[3] In addition to the references in Mr. Scoggin's paper, there is a short summary in the Carnegie Inst. of Washington *News Service Bulletin* 4: No. 31: 258–261. entitled "Early Man at Borax Lake." F. H. H. Roberts, Jr. ("The Folsom Problem in American Archaeology." *Smithsonian Inst. Ann. Rept.* 1938: 531–546, 1939) has stated clearly (p. 544) the problems raised by the California data.

NOTES AND NEWS

NORTHEASTERN AREA

Wendell S. Hadlock, Curator of the Robert Abbe Museum of Stone Age Antiquities, at Bar Harbor, Maine, reports that an intensive study of all Red Paint artifacts in the Museum has been carried on during the winter. This study is aimed at securing more definite information concerning the Red Paint culture, which has been much questioned by certain archaeologists.

"It has been found that in our collections there are certain types of artifacts that would not be thought of as from the Red Paint graves and which compare very favorably with many of our shell heap finds.

"It is expected that these studies will be concluded within a few weeks, at which time we hope to write a report covering the results of our work."

The Rochester Museum of Arts and Sciences announces the opening of a room devoted to the pre-Iroquois archaeology of New York State. Material from more than a score of village and burial sites, excavated by the museum, is shown in this fairly complete cross section of the earlier cultures of the state. Presentation is by sites or complexes, arranged in chronological sequence, and there is an introductory exhibit, illustrating by means of a map, chart and type specimens, the succession of occupations and their diagnostic traits, for each of the five geographical areas into which New York has arbitrarily been divided.

Dr. Nathaniel Knowles, Project Supervisor for the New Jersey Indian Site Survey, reports that: "For the past six months, the W.P.A. Indian Site Survey has excavated adjacent to the marsh along the river, below the bluff at the Abbott Farm. Three periods of occupation, as defined by distinct humus levels, have been found. Pottery is particularly abundant and, together with artifacts, refuse pits, and fire stone, extends to a depth greater than ten feet. Water conditions at present prevent deeper excavations.

"During the past winter, several sites were opened in southern New Jersey and adjacent to the Atlantic coast. In both localities, interesting material, mostly pottery, has been recovered from camp sites, but no extensive village site has yet been located."

Under the direction of Dr. Frank G. Speck, of the University of Pennsylvania, a field project has been undertaken in the ecology of the Virginia Tidewater Algonkian. In particular, a study of Pamunkey pottery as an acculturational trait was pursued. A preliminary summary of the data secured indicates a survival of aboriginal technique, such as has been recorded in the past by Pollard and Speck, among others. In recent years (since about 1926) a revived interest in pottery-making among the Indians of the reservation has led to two parallel courses, namely, the resumption of the older technique of the Virginia tidewater area, and the establishment in 1932 of a State-sponsored pottery school teaching new methods and introducing forms and decorations characteristic of the Southwest. The investigation of this problem was undertaken by Ted Stern, a graduate student in the department.

Ted Stern, of the Department of Anthropology, University of Pennsylvania, recently pursued further field work at the Pamunkey reservation in Virginia. Previous investigations have indicated certain promising leads offered by Pamunkey pottery-making. His investigations, which lie within the scope of Dr. F. G. Speck's researches on

the Virginia Tidewater Algonkians, were conducted specifically along the lines suggested by the work of Dr. V. J. Fewkes on Catawba ceramics. They reveal that, despite the counter-influence of new methods introduced by the State-sponsored reservation pottery school, an aboriginal technique has survived. Briefly, the technique is described by Mr. Stern as follows:—

"The clay, obtained from the communal clay pit, is first dried and sifted. It is then admixed with charred, pulverized mussel shells, in the proportion, roughly, of one to sixteen; next water is added to form a paste. By kneading and impact the paste is worked to the desired state of textural quality, whereupon the building process commences. The bottom of the vessel is modeled from a ball of clay; the wall is constructed by the circuit variant of the segmental process. In this manipulation, individual fillets are used, the ends of each being joined as they meet on the wall. The vessel may be shaped either during construction or later. A mussel shell is constantly applied, both inside and out, to thin, blend, and smooth the wall. After having been shaped, the vessel is allowed to attain the leather state, at which time handles and legs, if desired, are attached by inserting the ends into holes through the wall of the vessel. At this time, also, the rim and outer surface are decorated by grooving, by incising, and by impressing; the vessel is then polished with a rubbing pebble. Firing is done out of doors. After preliminary heating, the vessel is placed in the middle of the fire, and fresh fuel, consisting of pine bark and hard woods, is heaped over it. (If the day is windy an inverted iron cauldron is used as a cover.) In this manner the firing runs its course under reducing conditions, so that a dense black or mottled ware is obtained.

"The tectonics of Pamunkey pottery is especially interesting in the light of an examination of surface sherds from the reservation. These reveal that a very similar procedure was followed in aboriginal times." (*W. A. R.*)

NORTHERN MISSISSIPPI AREA

Thorne Deuel, Illinois State Museum, reports that a mound north of Peoria is being excavated with labor furnished by the WPA Museum Extension Project. This mound, as well as two others, was to be destroyed by Highway construction. Mr. Winslow M. Walker is directing the exploration.

A limited excavation at the Fisher Site near Channahon is being undertaken under the joint sponsorship of the Illinois State Museum and the University of Chicago with labor furnished by the WPA Museum Extension Project. Field work commenced April 29th, with Mrs. Gretchen Cutter in charge. The present work at this site is to supplement the very excellent exploration made some years ago by Mr. George Langford of Joliet and to solve certain problems that have arisen recently in the light of recent advances in archaeological knowledge.

The Ohio State University-Ohio State Museum Archaeological Expedition will spend six weeks in the field beginning June 16th. A limited number of students, having a general background in Anthropology and Archaeology, will be given instruction in excavating techniques. Headquarters will be established at Fort Ancient in Warren County, Ohio, and work will be carried on at the Fort and surrounding area. The group will be directed by Richard G. Morgan and H. Holmes Ellis.

Emerson F. Greenman, Museum of Anthropology, University of Michigan, will continue, during the 1940 season, the work of the past two years in the Manitoulin District, Ontario. A fortnight or more will be devoted to completion of the survey of the western-

most third of Manitoulin Island. The remainder of the season will be spent in the vicinity of Killarney, on the mainland, where further excavations will be made in two sites on post-Nipissing beaches. From this location exploratory trips will be made by land and water. The field party will consists of about eight people. For the first time, students will enroll in the Summer Session of the University for this work and will receive credit for work done.

The University of Minnesota expects to send a party under L. A. Wilford to investigate an historic Dakota village on the Minnesota river in an attempt to link it up with the prehistoric village sites at Mille Lacs. General survey trips and some mound excavation will also be undertaken during the summer.

The Indiana Historical Society, with the assistance of WPA, will continue exploration of the Angel Site in Vanderburgh County. During the winter months all washing and cataloging of material recovered last season was completed during the time when cold weather prevented outdoor work. It is possible that a survey will be conducted in the surrounding area to locate sites having relationship to the Angel Site. Several villages, now known, have produced surface collections of such a nature as to make test explorations extremely desirable. (*G. A. B.*)

The WPA Academy of Science of St. Louis project, with the analysis of prehistoric culture complexes in a restricted area south of St. Louis, and the incidental collecting of material to form a nucleus for a scientific museum in St. Louis as objectives, has been in operation since November. The Missouri Resources Museum joins with the Academy in sponsoring the work.

In a group of low burial mounds and accompanying village site on high limestone bluffs overlooking the Mississippi, one and possibly two archaeological components representing nomadic people of the Woodland Pattern were found. Crude vault-like structures of rock were built over partly-articulated skeletons without accompanying grave goods. Evidences of a structure with a fireplace, erected immediately after the burials were laid down, were found in the center of one mound. Cord-marked, pointed-bottomed pottery with notched decorations on or below the lip, rather small, coarsely chipped arrowpoints, grooved axes, and chert drills were found. Since the cultural material from the mound fill is similar to that of the surrounding temporary village site and since no artifacts accompanied burials, it is difficult to determine whether there are one or two cultural manifestations present.

A village and small mound of Mississippi affinities gave evidence of a large sedentary population who constructed three different types of square houses, consumed quantities of corn, and made pottery of several different shapes. It is significant to note that a count of pottery fragments shows that of two wares, A and B, $\frac{1}{4}$ of B and $\frac{3}{4}$ of A were from the village, but $\frac{3}{4}$ of B and $\frac{1}{4}$ of A were from the mound and from under the edge of the mound within a house structure. Overlapping shapes and other considerations show that the mound and village site were occupied by one group. Extended burials in stone box graves were accompanied by pottery and other objects. No sign of trade goods was found in sixty-one refuse pits that were excavated, precluding the possibility that this was a site occupied by the Shawnee, who are known to have buried in stone box graves, but were in the same general region at the end of the 18th century.

A large rock shelter on a bluff a mile west of the Mississippi has produced important results and yielded evidence to suggest that occupation during two geologic periods is

represented. A later gully fill contained evidences of many prehistoric, and at least one historic camping party. The deepest deposits here include a so-called Black Sand point and crushed quartz tempered pottery. The Black Sand points, long, and notched at the base, are believed to be very old in Illinois. The earlier group of deposits, with much less organic content, both underlies and flanks the more recent organic fill and contains highly patinated arrowpoints and a large well-chipped chert blade, but definitely lacks pottery. It appears therefore that we have a pre-pottery people of quite ancient origin. These earlier chipped implements, in a range of forms as great if not greater than that known to the more recent peoples, appeared on an old soil horizon containing very highly concentrated iron precipitate. It is the investigators purpose to have the deposits in such a condition that all interested and qualified geologists may conduct studies here and render their opinions at this most important site. (*Robert McCormick Adams*)

SOUTHWESTERN AREA

After an unusually active field season in the Southwest during the past year, present plans indicate less feverish times for archaeologists here. WPA and other projects, have reached the point in many cases where it is now necessary to turn to laboratory evaluation of results and suspend field work until these are completed.

The formation of the Council of Texas Archaeologists, with J. Gilbert McAllister as president, constitutes a great step in advance. Despite the forbidding title, the formation of such a group may well be the envy of other states in which archaeology is being seriously done. One of the first activities of the group was to unify procedures, and to establish a central clearing house and depository of information. Unification was established through committees, one of which has worked out methods of site designation, which, if they are followed, will make mutual transferrence of such information throughout the state possible, whereas in many other regions it is now utterly impossible. With individual cooperation such an undertaking should be most valuable. Other committees are to organize and unify such diverse activities as projectile point classifications and cave excavation techniques.

From Texas, W. C. Holden writes that Texas Technological College now has a WPA project along the upper Brazos River drainage in Texas, to determine, if possible, the relation of the so-called Abilene Culture, reported on by Ray, Sayles, and others, with the cultures of known horizons. The project is supervised by Joe Ben Wheat. One deep site on the Clear Fork River southeast of Anson, Texas, has been excavated and a number of typical artifacts found *in situ*. Definite relationships with other known cultures still remain to be established. The college will also have a class in Mexico City between June 6 and July 14, under W. M. Pearce and Donald Brand, to study expansion of Tarascan influences on the west side of the Mexican Plateau; women students will do archive work on the Yaqui Indians.

Erik K. Reed contributes the news that WPA work is being continued at Quarai, Kuaua (Coronado State Monument), and Pueblo Grande. The work at Pecos with NYA and Forest Service CCC labor has also continued. The National Park Service ruins stabilization program with Navaho CCC labor has gone ahead under Gordon Vivian at Chaco Canyon National Monument, and, under junior archaeologist Steen assisted by Paul Ezell, at Tonto National Monument. In the upper ruin at Tonto they have been finding unusual textiles and other specimens. The only other National Park

Service CCC archaeological project at present is the excavation at the University Ruin in Tucson which is being carried on for Haury by Julian Hayden.

At the A.A.A.S. meetings in Tucson, Haury, speaking for Sayles on the Mogollon problem, and at the Mogollon symposium, outlined the stages which Gila Pueblo has set up in dividing the Cochise culture of southern Arizona. These carry through from an extinct fauna to a modern fauna and pottery-bearing stage. Typologies, particularly stone, and to some extent ceramics, tend to link the latest of these stages with Mogollon Culture.

Later discussions of the Mogollon Culture at the Tucson meetings helped to define the problem in various regions. That it was a diffuse culture all agreed, but in defining derivations there was no real unanimity. Mogollon Culture still remains somewhat indefinite.

From the Field Museum Paul Martin writes that his report is now in press on the dig of last summer, and hopes to be back in the field again this summer.

Discussion of the Sandia Cave material by Hibben at the A.A.A.S. meetings in Tucson outlined these finds. The Sandia type was found in the lowest levels of this long, narrow cave associated with animal bones, mostly teeth. It is not like the Folsom type of point, and is stratigraphically separated from it by a stratum of damp yellow ochre. Above this layer are classic Folsom points associated with the bones of animals, and overlying all of this, and sealing it in, is a calcium carbonate layer. The Sandia point is somewhat like the Solutrean, and estimates of age place it about 25,000 years ago. No true Yuma points were found here.

Writing from Colorado, Earl Morris reports that since the first of the year a small party representing the University of Colorado Museum, with Charles Scoggin in charge, has been excavating a cave in Yampa Canyon, Dinosaur National Monument, northwestern Colorado. Decision to work the cave resulted from the finding of a cache by Frank Lee in the fall of 1939. It consisted of a coiled basket with one rod foundation and interlocking stitches; scores of noose snares and some fish lines with composite wood and bone hooks, each equipped with a slender thread for tying on the bait. The party had been snowed in up to April 15th, so that only brief reports of progress have been received. Several varieties of cists and a considerable range of perishable artifacts have been found. Some of the artifacts are presumably relatively modern, but there is expectation that a study of the full range of them will confirm frequentation of the cave as far back as a horizon equivalent to Basket Maker II of the San Juan drainage.

A report from C. T. Hurst states that the Museum of Western State College at Gunnison, Colorado, will hold its 1940 summer field work in Tabeguache Cave, Montrose County, August 4 to 18. Excavation will be carried on by the staff of the museum assisted by students. This will be a continuation of the work of last summer which is to be reported on in the June issue of *Southwestern Lore*. The cave is a Basket Maker site with exact affiliations not yet determined.

E. R. Smith, of the Museum of Anthropology of the University of Utah writes that he and Charles E. Dibble have continued surveying in that region, collecting samples from the caves in the eastern slopes of Lakeside Mountains, southwest edge of the Great Salt Lake, and mapped some ten new Puebloid caves and open sites for future excava-

tion. The expedition for the summer months will include a continuation of excavation at Wendover, and after four weeks in the field there, two weeks will be spent at Promontory Point and islands of Great Salt Lake. Also a two weeks trip into southeastern Utah, in the San Juan, for again checking Basket Maker and Pueblo sites.

The University of Arizona plans a second summer camp at Forestdale between June 15th, and August 15th, with the object of tracing further the northern extension of the Mogollon culture. Students taken from the department will constitute the field force. The Papagao project has just been completed for this season. Some of the early culture (between about 800 and 1100 A.D.), is definitely Hohokam, with traded painted Santa Cruz and Sedentary pottery, but there is also some other element, possibly early Papagao.

H. S. Gladwin writes for Gila Pueblo that part of the staff of the Pueblo is conducting research in tree ring analysis. Medallion XXVII describing the instruments used has been published and will be followed in the near future by Medallion XXVIII describing the methods of plotting ring measurement, evaluation, etc. Others of the staff have been conducting excavations and investigations in southeastern Arizona and an expedition is now in Mexico making an archaeological survey. This latter expedition is at the same time collecting beam material for the purpose of extending tree ring correlation to northern and central Mexico.

Mrs. Vickery, who has been working on the Besh-ba-gowa site near Globe informs the writer that the Inspiration #1 report is now finished and soon to be released. It pictures another site influenced by Hohokam and Mogollon culture in the Southwest.

Activities at the Museum of Northern Arizona have centered on the evaluation and presentation of the material gathered in this section. A report is nearing completion which will make clear the exceptional cultural mixtures found here.

Because of the rapid spread and development of the museum idea a large number of relatively small institutions, dealing mostly with more or less local problems, have been established in many parts of the country. While these museums are principally concerned with what is near to each of them, all realize that though they are working on one or more major problems only, a satisfactory progression of knowledge means that their work must be more concerted, or that they must at least keep in touch with the activities of other institutions. To further this idea of teamwork, practically all the museums of anthropology in Arizona, New Mexico, Colorado, West Texas and Southern California formed, in 1938, the Clearing House for Southwestern Museums. This is a loose confederation with a central office, at present located at the Denver Art Museum. Here files are being built to hold information on the collections, projects, and accomplishments of the member organizations. Members are kept in touch with each other through a monthly newsletter, which reports on various aspects of work, describes new technical methods evolved, lists the new books and articles for each month, and arranges exchanges between institutions of materials desired, including publications and objects. The Clearing House has just held its second annual meeting in conjunction with the Southwestern Division of the A.A.A.S. in Tucson. A good sampling of the membership discussed plans for the coming year, and agreed that the organization was beginning to achieve a useful place for itself in the field of southwestern anthropology. Membership dues and responsibilities are so arranged that all interested and worthy institutions may participate.

A need has long been felt here for some such central office for the organization and presentation of accumulating information. By such a clearing house procedure, it is hoped mutual aid may be secured in allied problems, duplicated effort prevented to some extent, and the points previously mentioned may be achieved. (*J. C. McG.*)

In order to afford greater protection to resources of an archaeologic, paleontologic, and scenic nature new regulations have been promulgated by the Utah State Park Commission under authority granted in Chapter 14, Section 1, Laws of Utah, Second Special Session, 1933.

Under these regulations all persons intending to carry on archaeological or paleontological excavations must apply for a permit granted by the Park Commission with the approval of the Board of Commissioners of the county in which the explorations are planned. The applicant must satisfy the Commission as to his qualifications, and must show what is to become of the specimens, viz., their disposal, the possibility of their being rechecked by others, and whether the information gathered will be published.

Although these regulations are aimed at pothunters, those officially connected with national exploration groups are not exempted from filing applications. Recognized scientific institutions should experience little difficulty in receiving permits. It will be interesting to see how many first rank archaeologists who consistently deride pothunters will file applications, and how many will roam at will as they have in the past.

In a few months in which the regulations have been in force they have resulted in the confiscation of some material and the arresting of amateur activities in some parts of the state. Penalties provided for in the Act stipulate a maximum fine of $300 and / or six months in prison.

Applications for excavation may be obtained from Elmer R. Smith, Museum of Anthropology, University of Utah, Salt Lake City, Utah. (*Carling Malouf*)

SOUTHEASTERN AREA

On March 25 of this year W. W. Luckett, who had been Acting Superintendent of Shiloh National Military Park, Tennessee, was appointed Superintendent of Ocmulgee National Monument. He is the first regularly appointed Superintendent to serve the Monument since its establishment.

The Lamar site is now known to be a palisaded village of about 21.5 acres. The semicircular palisade has a total length of about 3600 feet. Posts were set singly, but several periods of rebuilding have been noted in which parts of the original feature were replaced or strengthened. The palisade has been traced completely around the village with two small gaps near the "borrow pits" at the southeast and northwest corners. The connection of these large sinks with the palisade is not clear as yet. A probable entrance-way in the palisade has been discovered and is being explored. Stratigraphic tests indicate a very minor Swift Creek occupation, a moderate Macon Plateau settlement, and finally a large village of the Lamar aspect.

A report of the Macon Earthlodge has been completed. It was read at the Annual Meeting of the Society for American Archaeology at Indianapolis.

The construction of the large modern museum building has been progressing steadily. This building will be 40% completed by the end of June. A small temporary exhibition of pottery and artifacts has been installed in a portion of the finished basement. Exhibit plans for the permanent exhibit series are in preparation. (*W. W. Luckett*)

The Natchez Trace Parkway is conducting an archaeological reconnaissance of the general area traversed by the Natchez Trace Parkway under the direction of Jesse D. Jennings. The survey is designed to serve three major purposes. Primarily, the aim of the work is to locate sites in order to recommend their preservation where this is feasible, preserve data unavoidably destroyed through motor road construction, and determine which sites will best repay excavation. A second activity, to follow reconnaissance, will be the excavation of important sites, and the reporting of results. The third and ultimat- phase of the survey program is the utilization of survey data in preparation of pertinent n aterial for a comprehensive educational presentation by the public contact and educational personnel of the parkway staff.

In order to accomplish the ends outlined above, the winter months have been partially spent in a rapid surface reconnaissance, locating sites along the old Natchez Trace, and along the less devious route of the proposed parkway motor road.

After July 1, 1940, emphasis of the program will shift to excavation of strategic sites, and accompanying minor stratigraphic test pit work in other sites. Whether this work program can be carried out depends upon the approval of a Natchez Trace Parkway sponsored WPA project, modelled after a similar project directed by Robert Wanchope for the University of Georgia. (*Jesse D. Jennings*)

MIDDLE AMERICA

An expedition from the University Museum, University of Pennsylvania, Philadelphia, conducted excavations at the Sitio Conte, Cocle Province, Panama, from January 26 until April 14. The party consisted of J. Alden Mason, John B. Corning, Julia H. Corning and John A. Mason, Jr. Dr. and Mrs. S. K. Lothrop who directed the excavations at the same site for the Peabody Museum of Harvard University in 1933 accompanied the Expedition for the first few weeks, and gave it the benefit of their experience in commencing work. The results were naturally very much of the same type as those secured by the Peabody Museum Expeditions, and must await further study before it can be determined what new scientific data were secured. Some thirty graves and caches were excavated, many of them of large size, and some containing hundreds of pottery vessels mainly in fragmentary condition. Three tons of pottery were brought to Philadelphia but the restoration of these will take a long time. A large quantity of gold ornaments, many of them of large size and all of exquisite workmanship were secured, and these will be placed on immediate exhibition. (*J. A. M.*)

BOOK REVIEWS

Annual Report of WPA and the University of Texas Archeological Research, Lake Buchanan, 1936–1937, J. E. PEARCE, Director; *The Fall Creek Sites*, A. T. JACKSON; *Additional Buchanan Lake Sites*, ARTHUR M. WOOLSEY. The University of Texas Publication, Anthropological Papers, Volume III, Number 1, 1938.

To a steadily growing body of literature on the archaeology of the southern Great Plains comes another contribution—a continuation of the anthropological series issued by the University of Texas. The present volume contains field reports on investigations carried out jointly by WPA and the University at five sites in Llano, Burnet, and San Saba counties, on the Colorado River northwest of Austin. Two authors contribute their findings, which in general parallel each other, and apparently both concur in the conclusions. Instituted in an effort to salvage all possible archaeological data before inundation of the area by the newly-created Lake Buchanan, the work included also a reconnaissance at numerous other sites in the basin.

Bulk of the information here recorded was obtained by extended excavation in refuse deposits at old camp sites. From the middens, some as much as six feet deep, were recovered many manos and chipped flints, with lesser numbers of bone, antler, shell, and pottery artifacts. A few burials were also found. Excavation methods are inadequately described but field records seem to have been meticulously kept. The reports bristle with charts showing depth range of certain, presumably key, artifact types, and in addition contain summary tables listing the number of specimens of various categories by six-inch levels within each site. Site descriptions are followed with a general section discussing many of the artifacts in detail. All of this leads up to a 9-point summary of "possible tribal and cultural relations" and finally to the general conclusions. These, briefly, set forth two main culture periods, and seek to point out the direction and routes by which various elements reached the area in question.

So far as one may judge from these reports, the field work was well done, and a very considerable amount of much needed information from a previously little known region has been made available. Unfortunately, the reader who seeks to interpret the factual material himself, or to check conclusions against actual findings, is likely to encounter heavy going. For instance, much is made of the vertical distribution of projectile point and mano types and, inferentially, they are important criteria in the establishment of culture sequence. Much of their significance is lost in presentation, especially in the first and longer of the present reports. As an illustration, figure 9 shows, by means of bars, the distribution of 9 mano types (based on form) in successive 6-inch levels. The corresponding summary table on page 30, which shows the number of manos in each six-inch level, sorts them (other than edged) merely as large, medium, or small. Is size or form the more significant criterion? Even more loosely handled are projectile

points. Six or seven types are recognized in the presence and absence charts (figures 1, 3, 11, and 13). In the accompanying summary tables, however, there is but a single entry, and subtypes are entirely disregarded. Figure 1 (page 28) shows that 56 specimens (page 39) occur in 28 cells, each representing a 6-inch stratum; in figure 3 we find that 43 specimens are scattered through 27 similar cells. From this, one suspects a pretty thin spread, at least in spots, but it is futile to search for a statement as to the exact numbers which the bars in the graphs represent, or the number of specimens of each type at any given level. In the reviewer's opinion, actual numbers could have been presented as compactly as, and to greater advantage than, the bars.

The reader is further distressed by certain inconsistencies between the charts and the summary tables: e.g., figure 3 shows five types of projectile points in the 12–18 inch level but page 30 lists only four specimens; figure 9 has *no* edged manos in the 12–18 inch level, but on page 30 one specimen is so listed; and figure 13 shows *no* types of projectile points in the 0–6 inch stratum but the summary table on page 49 assigns two specimens to such a provenience. Unfortunate, as well as inconsistent, is use of the term "microlith" in the charts (figures 11, 13) to designate the small projectile points, or "bird points," of the text. To many persons, the word has a well established meaning quite different from that here assigned it.

From the standpoint of terminology, projectile points such as that figured in plate IV, 6, scarcely warrant the term Folsom-like. Mere thinning of the base, and not an actual fluting, is here exhibited.

On page 112 are described well made sherds with "roughly parallel striations on the interior" which . . . "suggests the possibility of the vessels having been shaped around some material, such as grass . . ." One wonders how these striae differ from those generally regarded as made by a smoothing stone, a possibility not suggested in the discussion.

It is not altogether clear in how far the summary on pages 116–117 is based on actual evidence contained in the preceding descriptive sections. The author sees "two major culture periods," but nowhere is there a clear concise statement as to what specific trait assemblage characterizes the "bottom level" culture, or as to the features which distinguish this from other complexes present. The edged mano is spoken of as a later intrusion (point 3, page 116), yet in the carefully controlled "burnt-rock area" of Midden 2, Site 3, in Midden 3, Site 3, in Midden 1, Site 2, and at Site 9, examples occurred either to within a few inches of the bottom of the mound or to depths below which occurred only one or two percent of the total artifact yield. The detailed records, while bearing out its comparative scarcity, would nevertheless give the type an antiquity comparable to virtually anything else uncovered by the present excavations.

Certain other statements need clarification. Point 7 (page 117), e.g., states that "the first occupants were driven out or absorbed; a new group took possession." This might imply an actual change of peoples and physical type, or it

might be merely the author's interpretation of changes in material culture as manifested in the archaeological inventory. In either case, proof is wanting, as well as explicit data on what changes took place at this time other than that from burnt rock to non-burnt rock middens. It seems a little hazardous to postulate a Comanche occupancy of the region on the strength of one extended burial dissociated from time-diagnostic or other identifying cultural objects, and a saddle. Neither satisfying nor convincing is the author's closing remark assigning his findings "roughly" to "the Woodland pattern, with slight intrusions of the Mississippi pattern."

The present report, in common with some previous papers dealing with the Texas field, apparently presupposes an intimate acquaintance on the reader's part with the work that has gone before. Like many of its predecessors too, this study will gain materially when, carefully synthesized, it is fitted into its proper position in the statewide or regional picture. At the moment, few outsiders can develop such a picture with any degree of satisfaction. The reviewer, whose field activities for some years have centered in a neighboring and not unrelated area hopes that the day may not be far distant when someone will draw together what is known of Texas archaeology, and present it in a form at once lucid, accurate, and as complete as the present data will permit.

WALDO R. WEDEL
U. S. National Museum

So Live the Works of Men. Seventieth Anniversary Volume Honoring Edgar Lee Hewett. Edited by DONALD D. BRAND and FRED E. HARVEY, Albuquerque, N. M., 1939, pp. 366, plates XXXV, $10.

Anthropology boasts more anniversary volumes relative to the size of its personnel than any other academic subject. To data the volumes range from Putnam to Kroeber and the end is not yet, as the present volume to Edgar L. Hewett testifies. There are 28 articles by 27 contributors, all associated with Dr. Hewett at some period in his professional career. As in most volumes of this kind, the titles of the papers range far afield, but at least 19 can be considered anthropological. To review each article in turn is impractical, so mention will be made of those most likely to interest the readers of this journal.

Dr. A. V. Kidder, whose name carries weight in all archaeological matters, contributes some notes on Chihuahua as a tribute to Hewett's pioneering in that country at the opening of the century, as had Bandelier's excursions across the Rio Grande some twenty years before. Interestingly enough, Kidder's notes were taken about twenty years after Hewett's visit. Seemingly, all Kidder expected his notes to convey was that Hewett's conception of the importance of Chihuahua in broadening the base to the reconstruction of Southwestern history was fully justified.

Professor Donald D. Brand writes of the geography, history and archaeology of the country around Zape, Durango. Recently J. Alden Mason published

some data on the valley of the El Zape River. Brand saw no direct evidence that southwestern culture penetrated the locality but there was abundant evidence of influence from the South. This is another indication that the direction of diffusion was from Mexico north, rather than from the Southwest into Mexico.

Frank H. H. Roberts, Jr. contributes a review of the unit-type dwelling in the Southwest, a problem of major importance first proposed by Prudden in 1903. Roberts shows clearly that with the tree-ring and ceramic dating methods, ruined dwellings can be time sequenced, and that the series shows a transition from the pit house and associated granaries to the well known pueblo type and the kiva. This gives objective proof of a genetic series in a culture complex and justifies painstaking chronological research. So far, the evolution of the unit-type dwelling is the most satisfactory example of processes which heretofore have lacked objective proof and indicates that, at last, the evolution of culture complexes is coming into its own.

Although Hewett's field of research has been the Southwest, there are but three more archaeological papers dealing with the same area. Miss Florence M. Hawley outlines the history of the tree-ring research but is too brief to give an adequate sequence of events in its evolution. Then follows a general statement of the underlying phenomenon which makes dating possible, but the most important part of the paper deals briefly with the conclusions drawn from trenching the bed of the Chaco near Chetro Ketl. Erosion and deposition horizons were observed, in the upper series of which were samples of pottery. (*See* Senter, AMERICAN ANTIQUITY, Vol. 3, July 1937.) It is unfortunate that Kirk Bryan's observations in a cross-section of the canyon bed at Bonito remain unpublished. Since changes in erosion and deposition can result from changes in the environment independent of rainfall fluctuations, especially changes due to the presence of man, data of this kind should increase the significance of tree-ring dating, so Miss Hawley thinks. At least she suggests how a precipitation curve may be projected from past time. As usual in anniversary volumes this article is too brief to be more than tantalizing.

The article by Bryon Cummings on Early Days in Utah is a brief sketch of archaeological exploration in that state. Finally Dr. F. W. Hodge gives a description of a rectangular kiva at Hawikuk, with historical notes. The importance of this kiva arises from the dating.

"There is evidence that the Zuñi people forsook their pueblos more than once between the years 1540 and 1680, and that during one of these periods Hawikuh fell into decay, only to be rebuilt later. The excavations, conducted at the site amply proved this, for the latest dwellings of the pueblo were erected above the level of the great fill of sand and refuse over the roofline of the kiva."

Dr. Morley, Carnegie Institution, discusses twelve new inscriptions found at Copan in 1935–1937. They fall chiefly within the Great Period, probably in the first three katuns.

Dr. Hewett was interested in the living Indian, too, so we need not be surprised to find ethnological articles included in the volume. For example, the late Hartley B. Alexander's article on the horse is chiefly an appreciation of the art of the Plains Indian as shown in drawings of the horse. The chief contribution is the discovery of a masterpiece in beadwork from Warm Springs, Oregon. The artist is unknown, but it is doubtful if any contemporary rival to this beaded horse will ever be discovered. This discussion added to the recent art study by Ewers, opens up one aspect of the Indian-horse problem not previously considered.

Miss Frances Densmore writes a brief appreciation of Indian song texts as poetry. She thinks that war themes dominate but that the beautiful in nature runs a close second. She tries the experiment of translating the thought expressed in the Indian text in English words which fill out the rhythm in the Indian music; the result suggests that many of the original song texts are good examples of poetry, and that the emotional reactions of the Indian and white are about the same in such situations.

Reginald G. Fisher presents a useful outline of pueblo Indian government and J. P. Harrington a note on California basketry technique and a study of what the Kiowa traditions contain respecting their residence around the Black Hills, using linguistic data as a check.

The additional articles deal with miscellaneous topics chiefly outside the American field. The range of the topics in such a volume as this may remind one that anthropology is usually considered a pure science, one without any use in the world, an intellectual and emotional luxury, but as a fit closing we note Lyman Bryson who writes on Anthropology and Education. To his way of thinking the commonplaces in anthropology "should be made known to those who are expected to train in the public schools the minds of the nation's youth."

CLARK WISSLER
American Museum of Natural History

The Jemez Pueblo of Unshagi, New Mexico, with Notes on the Earlier Excavations at "Amoxiumqua" and Giusewa. PAUL REITER. Monograph of the University of New Mexico and the School of American Research, Monograph Series, Vol. 1, No. 4, 211 pp., 23 plates, 24 figures, University of New Mexico Press, Albuquerque, 1938.

Although the Jemez region of north-central New Mexico has been for many years the scene of a great deal of archaeological investigation, almost none of this material has so far appeared in print. Therefore this complete and thorough monograph of Mr. Reiter's on the excavations of three major pueblos, Unshagi, "Amoxiumqua," and Giusewa, in this particular area is of particular interest to all students of Southwestern archaeology and ethnology.

Part I of this report begins with a general introduction to the Jemez province, its geology, climate, fauna and flora, and the distribution of the sites. Fol-

lowing this is a chapter on the historical aspects of the region since 1540. The Major portion of Part I deals with the field work at Unshagi, with a brief concluding section on the earlier field work at "Amoxiumqua" and Giusewa. Part II is mainly devoted to a detailed discussion of the material culture of Unshagi, the pottery and other artifacts. The closing chapter provides the Traditional and Ethnological Evidence and Summary. This is followed by an extensive bibliography.

Included also are the following six appendices: Sherd counts from stratigraphic cuts; A tabulation of Unshagi room features; A tabulation of Unshagi burial data; Unshagi tree ring dates, by W. S. Stallings, Jr.; Description-illustration table of Jemez pottery; and Technological notes on the pottery from Unshagi, by Anna O. Shepard.

The Jemez pueblo of Unshagi consisted of from two hundred to two hundred and fifty rooms grouped around a square, with extensions on two sides forming a second court open at the southern end. Two kivas were located in this second plaza, with a third just to the east of the main group. These three kivas, together with one hundred and one rooms, were excavated. As is usual in pueblos of this type and period, not all of the rooms were occupied contemporaneously.

The masonry employed in wall construction was very crude, uncoursed, composed of rocks and boulders from the vicinity. This rough masonry was commonly covered with several coatings of plaster, the outer layer or layers being of brown clay or gypsum.

Reiter separated the excavated rooms into three classes, basing the classification on the secondary structures or furnishings of the rooms. Class A consisted of rooms with no furniture or floor features, often unplastered; these were probably storage rooms. Class B rooms were those having several floor features, as a firepit, bin, or deflector, together with plastered walls; these were undoubtedly living rooms. Rooms having a firepit, deflector, bins in adjacent corners, and a vent or door were grouped in Class C; it is suggested that this type of room may have served either as a ceremonial or clan room or as a storage room for corn.

An original two and three storied structure is postulated for the central sections of the pueblo. While, as has been pointed out,[1] fireplaces ordinarily do not occur in rooms underlying second and third stories, still they have been noted. This feature is particularly true at Kinishba,[2] where in several cases superimposed fireplaces were found, unmistakably showing where a second story fireplace had fallen through the roof and now rests anywhere from a few inches to a foot or more directly above the first floor firepit. Pottery, metates, axes, etc., in the fill of these and other rooms at Kinishba show evidence of second and

[1] Kidder, A. V., Review of Reiter's Jemez Pueblo of Unshagi. *American Anthropologist*, Vol. 41, No. 2, p. 317, April, 1939.

[2] Baldwin, Gordon C., Excavations at Kinishba Pueblo, Arizona. AMERICAN ANTIQUITY, Vol. 4, No. 1, pp. 11–21, July, 1938.

third story rooms located over first floor rooms with firepits. The pottery and associated artifacts show a contemporaneous occupation of the first, second, and third story rooms.

The three kivas excavated conform in general to the characteristic Rio Grande type, lacking pilasters and benches, and having heavy masonry altars, large ventilator shafts opening at floor level, and occasionally loom holes. The ventilators of two of the kivas, however, open to the south, while only one opens to the east.

One hundred and ninety-one burials were recovered at Unshagi. Of one hundred and sixty-two recorded instances only ten were fully extended, the others all showing some degree of flexing. The most common burial position was face down, and a majority of the burials had the head to the west.

The major section of Part II of the report is devoted to a discussion of the pottery and other artifacts, and, for many, will constitute one of the most interesting parts of the report, together with Miss Shepard's report on the technological study of the pottery from Unshagi, given in Appendix VI. Although the Rio Grande glaze-decorated wares, Glaze I through Glaze V, all occur at Unshagi, they are in the minority, Glaze IV only appearing in any appreciable quantity. The chief locally developed type, Jemez Black-on-white, was the characteristic form. From a study of the ceramic sequence, Unshagi appears to have been established in the latter part of the fourteenth century, about 1375 A.D., and was occupied through Glaze V, until 1628. Tree ring dates secured by Mr. W. S. Stallings, given in Appendix IV, bear this out, the dated span of the pueblo extending from 1402 to 1605.

The other material culture objects that are noted are the following: worked sherds, as spindle whorls, gaming disks; miniature pottery vessels; both round and flattened clay pipes, several having incised decoration; bone and antler awls, flakers, etc.; an extreme rarity of ornaments; objects of chipped stone; flat metates, none in bins, however; rectangular manos, both short and long, with several triangular manos; very few arrow-shaft straighteners; grooved stone axes; and a few examples of textiles, including a single checkerboard woven sandal of yucca leaf.

All in all this report of Mr. Reiter's presents a well-rounded summary of the culture of the Jemez province throughout the greater part of Pueblo IV, a period important in the history of the Southwest, important in the earlier part for the contraction of the area by pressure from outside, and in the later part through the coming of the Spanish and the consequent introduction of Spanish materials and ideas.

GORDON C. BALDWIN
Arizona State Museum
Tucson, Arizona

SOCIETY FOR AMERICAN ARCHAEOLOGY

ANNUAL MEETING—1940

The fifth annual meeting of the Society for American Archaeology was held on April 25 and 26, 1940, in Indianapolis, Indiana, in conjunction with the nineteenth annual meeting of the Central States Branch of the American Anthropological Association. Headquarters were the Hotel Marott. The fifth annual business meeting of the Society was called to order by Mr. Glenn Black, Vice-President, late in the afternoon of April 25. About 25 people were present.

The minutes of the fourth annual meeting were approved as printed in AMERICAN ANTIQUITY. The report of the Editor and of the Secretary-Treasurer were read and accepted. It was then moved, seconded, and passed unanimously that "the Society for American Archaeology wishes to record formally in the minutes of this meeting its very great appreciation of the services rendered the Society by Dr. Guthe as first Secretary-Treasurer."

Dr. Fay-Cooper Cole, as Chairman of the Nominating Committee, then presented the report of that committee in the form of the following slate:

President: W. C. McKern
First Vice-President: Charles Amsden
Council: Glenn Black and A. T. Hill
Secretary-Treasurer: Thorne Deuel
Fellows: Luther S. Cressman and Froelich Rainey

Nominations from the floor were called for. There being none, it was moved, seconded and passed that the nominations be closed and the Secretary be instructed to cast a single ballot in the name of the Society for the slate as read. Mr. Black thereupon declared the new officers and Fellows to be elected.

Under the heading of new business, and following a brief discussion, it was moved and seconded and passed that a committee on terminology be created, to study the problem of terminology as related to archaeological materials and data, including the formulation of definitions for the terms recommended. The committee, which was instructed to report at the next meeting, was appointed at once by Mr. Black as follows: Andrew Whiteford, Chairman, Vladimir Fewkes, Richard Morgan, and Charles Wilder. There being no other business to come before the Society the meeting adjourned at about 6 o'clock.

The combined meetings of the two organizations occupied the three days of Thursday, Friday, and Saturday, April 25–27. Thursday was devoted entirely to the Society for American Archaeology, and Saturday to the Central States Branch. The meetings on Friday were held jointly. Thursday morning's session consisted of the reading of a few individual papers, the titles of which are listed at the end of this statement. Thursday afternoon Mr. Glenn Black presided at a symposium on Terminology. This meeting was opened with the reading of a letter upon the subject by Schuyler Miller of New York. Following a brief statement by Miss Kneberg concerning the need for accurate terms to describe archaeological materials, Mr. Whiteford presented informally an outline of the system used at the Archaeological Laboratory of the University of Tennessee in classifying stone and bone materials. This was followed by a brief description by Mr. Wilder of his proposed formulae for describing pottery shapes on the basis of relative proportions. Later Mr. Haag outlined the principles upon which the pottery classification now in use in the southeastern states was established. The informality of the symposium, which permitted the speakers to be interrupted, and allowed many of those present to participate in the casual discussion, greatly enhanced the value of the meeting. During these discussions Mr. Morgan read the report of a meeting on a similar subject which had been held at the time of the annual meetings of the American Anthropological Association in San Francisco in 1905, and Mr. Ellis brought up the question of the status of an informal committee on this subject which he recalled had been appointed at the last annual meeting in Ann Arbor. The symposium closed with a statement by Florence Hawley Senter on the progress which has been made in the dendro-chronological studies in the eastern United States, at the end of which she presented an urgent plea for greater care in the preparation and packing of wood samples sent to the Dendro-chronological Laboratory.

The joint session on Friday morning was devoted to a symposium on the Methods of Cultural History, with Dr. Bennett and Dr. Park as Co-Chairmen. The session was opened by W. C. Bennett with a presentation of the problem. W. D. Wallis then spoke on Age and Area Reconstruction, H. Hoijer on Language and Time Perspective and C. E. Guthe on Archaeology and Reconstruction. W. V. Park closed the symposium with a statement on Summary and Conclusions.

On Friday afternoon an informal and unscheduled symposium was held, attended by some twenty

archaeologists, during the course of which preliminary steps were taken in formulating the activities of the Committee on Terminology appointed at the annual business meeting.

The combined annual dinner of the two organizations was held Friday evening and was followed by a public evening lecture on "The Trinidad Negro" by Melville J. Herskovits of Northwestern University, during the course of which he played a number of records of songs and ceremonies obtained during his field work in Trinidad.

THURSDAY MORNING SESSION

Preliminary Report of the Dolly Bond Steatite Quarry, Millbury, Massachusetts. Ripley P. Bullen.

The Macon Earthlodge. Charles H. Fairbanks.

Preliminary Report on Cherokee County Archaeology. Lynn E. Howard.

The Neosho Focus. David A. Baerreis.

The Location of the Missouri Village Site. Brewton Berry.

An Outline of Southwestern Iowa Archaeology. Charles R. Keyes.

A Minnesota Blade Associated with Human and other Animal Remains. (Read by title) Gertrude Evans.

Ethnological Notes on the Ottawa. Paul Weer.

CARL E. GUTHE, *Secretary-Treasurer*

REPORT OF THE EDITOR

Volume V of AMERICAN ANTIQUITY now stands complete with the release of the April issue, which should be in your hands by this time. As a slight change from precedent the table of contents is this year included with the last number of the volume instead of the first number of the immediately succeeding volume. It is hoped that in the future this practice can be continued, making each volume a self-contained unit. The number of pages, 372, compares favorably with Volume IV.

The sudden increase in material for the Notes and News section of the journal has made it necessary to adopt a stricter policy with regard to matter to be published, and in the future only newsworthy items will be accepted. This must be so if our proper portion of major articles is to be published.

It is interesting to note the continued popularity of the Facts and Comments division; unfortunately, budgetary limitations make it impossible to print as rapidly as possible all the illustrated papers that are submitted. Ten short papers, all but one of which are accompanied by illustrations, are now in the files.

Arrangements have been made to publish papers that are somewhat longer than usual through a subsidy by the author or the sponsoring institution for that part of the paper in excess of the limit for the journal. Although there is a falling off in the number of papers received during the year, the few papers now on hand are all long papers. The decline in the rate at which papers have been submitted has been a cause for some concern; it is to be earnestly hoped that enough papers will continue to be submitted to permit the editor to assemble numbers in which at least two papers in the same issue will bear some relation to each other.

The bright future forecast for the NOTEBOOK at the last annual meeting of the Society seems to have been short-lived. Contributions for this release have been extremely slow—so slow, in fact, that the Editor of the NOTEBOOK has been forced to write the major part of at least one number himself, and to appeal for contributions for other numbers. Only 13 members have taken the trouble to submit articles, and some of these were solicited; in addition, briefs of papers for meetings have been run. Unless there is more of a response in the way of contributions to the NOTEBOOK it seems wise to consider abandoning it entirely. If there is anything in the form or management of this release that is open to criticism, rest assured that any suggestions would be deeply appreciated. The Editor of the NOTEBOOK, himself, has been and will be the first to appreciate cooperative comment of a practical nature.

In closing let me say that I am deeply grateful to our first Editor, and our Secretary-Treasurer, for the help and guidance they have given me; without their aid the task of the new Editor would have been immeasurably heavier.

Respectfully submitted,

DOUGLAS S. BYERS, *Editor*

REPORT OF THE SECRETARY

The fourth annual meeting of the Society for American Archaeology was held on May 5 and 6, 1939, in Ann Arbor, Michigan, in conjunction with the eighteenth annual meeting of the Central Section of the American Anthropological Association. The minutes of this meeting were printed in AMERICAN ANTIQUITY, Volume V, No. 1 (July, 1939), pages 36–41.

It had been hoped that before the coming of this present annual meeting, the membership of the Society might be increased to 1000. While this total has not actually been achieved, the growth in member-

ship has been encouraging, and has continued at approximately the same rate as during the fiscal year 1938–39. There has been the hope on the part of some that our journal and the NOTEBOOK might be increased in size in order to render a greater service to our membership. In order to attain this desire it is necessary to increase our number of Affiliates, and your Secretary requests that the Fellows and the Affiliates continue to render the assistance they have in the past in expanding the usefulness of the Society. The changes in membership in terms of classes are given in the following table.

	May 2, 1939	Withdrawn	Transferred	Added	April 1, 1940
Life Fellows and Affiliates	9		1		10
Fellows	60		12		72
Affiliates	722	−64	−12	95	741
Institutional Members	95	− 1	− 1	6½	99½
Totals	886	−65		101½	922½

The column headed "withdrawn" needs additional explanation. The Society lost by death during the past year three Affiliates, namely Colonel John R. Fordyce, Mr. Robert F. Gilder, and Mr. H. F. Wenning. Fifty-one Affiliates were dropped from the rolls of the Society at the beginning of this fiscal year, because they were two years in arrears in payment of dues. During the year 13 Affiliates and 1 institution have resigned their membership. The column headed "Transferred" records the fact that one Affiliate took out a Life Membership, and that an institutional membership was transferred to an Affiliate. The partial institutional membership added during the past year is accounted for by the payment of one-half year's dues by one institution. Although the total membership as of April 1 is only a little more than 900, it is hoped that the roll of 1000 will be more closely approximated before the end of the fiscal year through the continued receipt of new memberships during the coming three months.

Several actions have been taken by the Council of the Society since the last annual meeting. Late in September 1939 it authorized the holding of a regional meeting of the Society in Chicago, Illinois, in connection with the annual meeting of the American Anthropological Association and the American Folklore Society on December 27–30, 1939. Late in January the members of the Council set the date for the present annual meeting here in Indianapolis. In March the Council approved the suggestion made by a Fellow of the Society that a regional meeting be held in connection with the annual meeting of the Southwestern Division of the American Association for the Advancement of Science which met the early part of this week, April 22–25, in Tucson, Arizona.

Since a carefully organized program had been worked out well in advance for the meetings of the American Anthropological Association in Chicago last Christmas, and since the Chairman of the Program Committee of that Association was a Fellow of the Society, it was not deemed necessary to have a program committee of the Society appointed by the President for that regional meeting. Early in February the President, Mr. Neil M. Judd, did, however, appoint two committees to serve in connection with the annual meeting now in progress. The first was the Nominating Committee: Fay-Cooper Cole, Chairman, Harold S. Colton, and Waldo Wedel. The second was the Program Committee: Carl E. Guthe, Chairman, W. C. McKern, and William Haag.

Since the organization of the Society, it has been one of the functions of the Secretary-Treasurer to act as a clearing house for advice and information for the Affiliates and Fellows of the Society. In addition to the routine duties of the office, I have enjoyed the opportunity to correspond with many professional and non-professional students of American archaeology. Unfortunately, the correspondence has been so voluminous that I have not always been able to answer the many letters as promptly as I should. For this I give due apologies now. You are all acquainted with the objectives of the Society. May I take this occasion to emphasize again that the services which the Society can render its members depend to a considerable degree upon the cooperation of each Affiliate and Fellow. Opportunities exist in the pages of the journal and in the more informal NOTEBOOK for making inquiries, stating opinions, and recording activities. If greater use is made of these facilities the Society will become stronger and more integrated.

Finally, because of the many demands made upon my time and energy, it is necessary for me now to tender to you, regretfully, my resignation as Secretary-Treasurer of the Society for American Archaeology

Respectfully submitted,

CARL E. GUTHE

REPORT OF THE TREASURER

The present balance (April 1, 1940) of the Society stands as follows:

Regular Fund	$ 46.33
Permanent Life Membership Fund	526.57

REGULAR FUND

Gross Receipts

Balance on hand, May 2, 1939		$ 233.32
Dues:		
1937–38	12.00	
1938–39	357.00	
1939–40	1750.50	
1940–41, and 1941–42	57.00	
		2176.50
Sale of back volumes of AMERICAN ANTIQUITY	156.00	
Sale of single copies, AMERICAN ANTIQUITY	9.50	
Sale of 1938–39 pages of the NOTEBOOK	2.25	
		167.75
Reimbursements (Reprints and illustrations)		96.20
		$2673.77

Gross Disbursements

AMERICAN ANTIQUITY		
Printing, illustrating and distribution (4 issues)	$1800.77	
Reprints	144.56	
Cases for storage of stock	5.80	
		$1951.13
THE NOTEBOOK		
Supplies (May 1939 thru Feb. 1940)	197.30	
Postage (June 1939 thru Feb. 1940)	84.75	
Extra office help	15.60	
		297.65
Secretarial Assistance and clerical help		
Office of the Secretary-Treasurer	94.95	
Office of the Editor	91.84	
		186.79
Stationery and printing		47.16
Postage, telegrams, and express		107.58
Bank service and exchange charges		22.58
Discounts to subscription agencies		14.55
Cash on hand, April 1, 1940		46.33
		$2673.77

Resources

Cash on hand, April 1, 1940	46.33
Due from 1938–39 dues	165.00
Due from 1939–40 dues	564.00
Due from reimbursements	58.04
	$ 833.37

Liabilities

Dues for 1940–41 and 1941–42 already paid	57.00
Secretarial and clerical assistance	20.00
April, May and June Notebook (Bills not yet submitted)	?
AMERICAN ANTIQUITY, vol. V. no. 4 (Bills not yet submitted)	?

PERMANENT FUND

Receipts

Balance, May 2, 1939	469.13
Dues from one Life Affiliate	50.00
Accrued interest	7.44
	$ 526.57

Disbursements

None	000.00
Balance on hand April 1, 1940	526.57

It is gratifying to note that this year the Permanent Fund of the Society has passed the $500 mark. The very low balance for the first of April should be considered in relation to the Resources of over $800, most or all of which will be realized during the next three months, before the close of the fiscal year. This sum will amply meet the Society's liabilities.

The expense of the Notebook has been an item of interest. Since the first pages were issued in February 1939, seven sets of pages have appeared before April 1, 1940. On the average, these cost just a little less than $70.00 an issue, or, in the terms of pages, $4.90 a page, for an edition of 1000. By using both sides of the sheet, the number of sheets are reduced, and the postage is cut in half. This lowers the cost per issue from about $70.00 to about $55.00, a saving of approximately 20%.

Respectfully submitted,
CARL E. GUTHE, *Treasurer*

SOME RECENT PUBLICATIONS

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Douglas, F. H., *Main Types of Pueblo Cotton Textiles* (Denver Art Museum, Dept. of Indian Art Leaflets 92–93. pp. 166–172. Denver, 1940).

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